SOYA BEAN

ITS VALUE IN DIETETICS,
CULTIVATION AND USES,

WITH 300 RECIPES.

F. S. KALE, B.A. (Bom.),
A.R.S.I. (Lon.), F.A.P.S. (N. Y.),
D.H.M. (Switz.) etc.
Food Survey Officer, Baroda State.

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DEDICATED TO MY NOBLE MASTER

HIS HIGHNESS THE MAHARAJA SIR SAYAJI RAO GAEKWAD OF BARODA.

G. C. S. I., G. C. I. E , LL. D

ROYAL FARMER.

who takes keen interest in Soya Bean.

PREFACE.

This little book is written in response to innumerable inquiries I have had from time to time after the inauguration of the plantation ceremony of Soya Beans at the State Agricultural Experimental Station by H. H. the Maharaja Gaekwar of Baroda in November 1933.

A few months after this a food exhibition was held in Baroda where many Soya Bean dishes–Indian, European and Chinese were exhibited. The leading papers and journals all over the country spoke in very glowing terms about the Soya bean dishes that were exhibited. This created further interest which resulted in asking for further information about the preparation of Soya bean dishes. Later on at the request of Messrs. Mitsui Bussan Kaisha Ltd., a leading Japanese Firm in Bombay, a Soya Bean Exhibition and Restaurant were run in the Japanese village at the H. O. H. fete. So keen was the interest

and enthusiasm evinced by the cosmopolitan public of Bombay that seats in the restaurant had to be reserved in advance. The presence of H. E. the Governor and Lady Brabourne and many Indian princes was an additional evidence of the ever growing popularity of the tasty soya bean dishes served there.

At the closing of the H. O. H. fete many prominent people of Bombay requested me to continue the restaurant at a convenient place in the city, and asked me to open soya-bean milk centres for the children of the poor who could not afford to buy cow's milk. Many were ready to finance any scheme that I would propose, but unfortunately my time was not my own as I had to attend to my duties in the State and could not take advantage of their generous offer.

The Departments of Agriculture of the various provinces of India as well as many Indian States asked me to supply them with literature regarding the cultivation and the uses of this most useful bean. The Department of Commerce and Industry of the Government of Bombay inquired if I could

furnish them with information about the machinery for the extraction of Soya-bean milk. Letters of inquiries from private individuals kept pouring in daily from all parts of India. All this has induced me to undertake the preparation and the publication of this book.

It is my ardent desire that soya-bean which contains the highest amount of protein, abundance of mineral salts and the three vitamins, should form a part of the daily diet of the people of India. From the number of experiments carried on in the Baroda territories and outside it, I feel sure that the Indian soil is most suitable for the cultivation of Soya-bean. It improves the soil as it takes nitrogen from the air and transfers it to the soil. The Crop Conference of the Agriculture Department of the Government of India held at Delhi last May, recommended that soya bean should be tried as a rotation crop.

The leading thought of the day in India is, "Village uplift," and "Rural reconstruction." Every one talks and thinks about it. The British Government and the Indian

States are seriously thinking in this direction. Big schemes are being launched and large sums of money are set aside for this purpose. At this opportune moment may I request the Government Authorities and the leaders of Indian thought, to incorporate the problem of national nutrition in their schemes of village uplift, and see that the people are adequately instructed in the nutritional values of various types of food ? The problem of national nutrition is as important as the provision of efficient sanitation in Indian villages and towns. On nutrition depends the stamina, efficiency and longevity of a race. It is the duty of every good government to see whether there is a proper adjustment of food supply to the population and of the population to the food supply, for hungry and half starved people invariably prove a menace to the State in the long run.

In conclusion, I cannot allow this opportunity to pass without expressing my deep sense of appreciation and gratitude to the benign and enlightened ruler H. H. the Maharaja Gaekwar of Baroda, who in his zeal for an alround uplift of his people, guided

and encouraged me in my study of dietetics in general and of soya bean in particular, I have to thank the different Agricultural Departments to the Provincial Governments for supplying me with the facts and figures of their experiments.

I have to thank my friend Mr. I. P. Parekh, B. A. for going through the manuscript.

Lastly, my thanks are due to the Manager and the staff of the Baroda State Press for hurrying up the work for the opportune Diamond Jubilee Celebrations of His Highness the Maharaja of Baroda.

I shall deem my labours amply rewarded, if the reading of the following pages will succeed in creating and stimulating a genuine interest in the cultivation and the use of this most important bean in India.

Baroda, F. S. K.
7th. January 1936.

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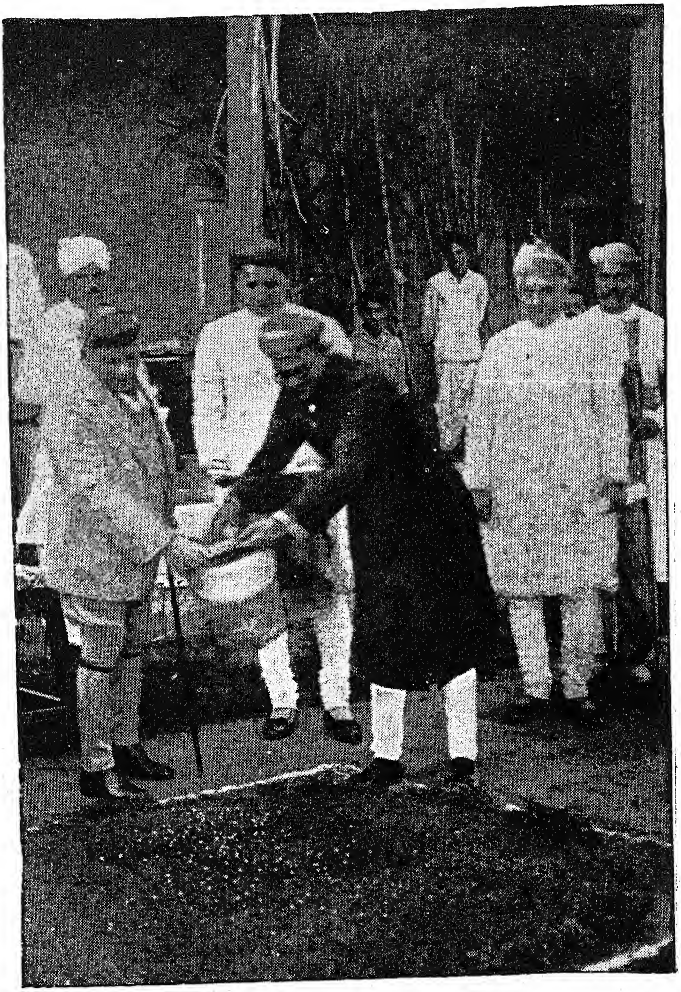


H. H. the Maharaja Gaekwar of Baroda the first Indian ruler to inaugurate the soya bean plantation ceremony in his state 24th November 1933.

CHAPTER I.

"*By food the living live.*"

EDWIN ARNOLD.

Deficiencies in Indian Dietary and Soya Bean as a means to rectify them.

General considerations.

It is an admitted fact that the health, efficiency and longevity of a race depend chiefly on good food. Diet plays an important part in the formation of blood, bones and muscles. Human body is a working machine that derives its driving force chiefly from the fuel of food. It is an aggregation of innumerable living cells in which diverse chemical changes are continually happening. The body cannot perform its vital functions and repair the constant wear and tear of the living cells without the proper balance of chemical compounds in all its tissues and

fluids and these compounds must be derived from a well-balanced diet.

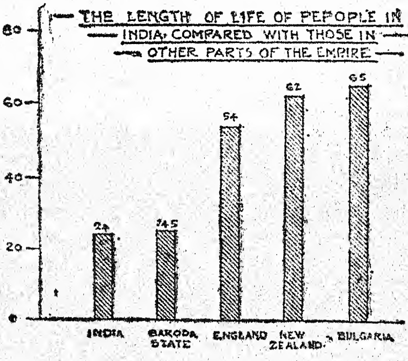
What is meant by a "Balanced Diet" ?

Some people believe that the making of a well-balanced dietary requires several hours of a day of careful calculation. No, it is not so. If one knows the general principles of diet, he will be able to arrange his menu in a minute's time. " Balanced diet " does not mean that different kinds of foods are to be actually weighed in a balance in strict proportions. It only means that the daily diet should contain different ingredients or components of food in certain proportion. Our body may tolerate occasional variations in our dietaries, but a continued excess or deficiency of one or more ingredients may affect our health and cause diseases. Dr. H. V. Tilak of the Bombay Baby and Health Week Association has issued his phamplet on "Balanced Diet" recently and it may be gone through.

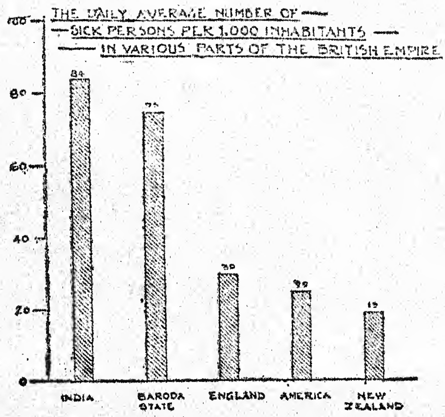
Results of unbalanced diet.

The diet of many millions of people in India is defective and cannot maintain either

efficiency or health. Unbalanced diet, faulty nutrition, and insanitary conditions of life are the root cause of many diseases, such as, intestinal and kidney troubles, malnutritional oedema, epidemic-dropsy, scurvy, rickets, stone in the bladder, beri-beri, blood poisoning, eczema, night blindness, pellegra, osteomalacia, tetany, dental caries, disorder of pregnancy, obesity, gout, tuberculosis, nervousness and above all lowering down of vitality, stunted growth, less resistance to diseases and shortening the span of life. A diagram showing the average length of life in India and comparing it with the life of people in other countries of the world is given below.



Even this short span of life is not full of sweetness and happiness as sickness and diseases are very common in India. Diagram showing the number of sick persons per 1000 in India and comparing it with those of other countries of the world is given below.



Owing to the lack of proper nourishment, resulting in low stamina and vitality to resist any disease or epidemic like influenza, many people are swept away every year. The number of men carried away in one year

exceeds the number of men carried away by the Great War in four years by 70 lacs. This clearly shows how low is the vitality of the people of India.

Poor efficiency of Indian labour due to improper feeding.

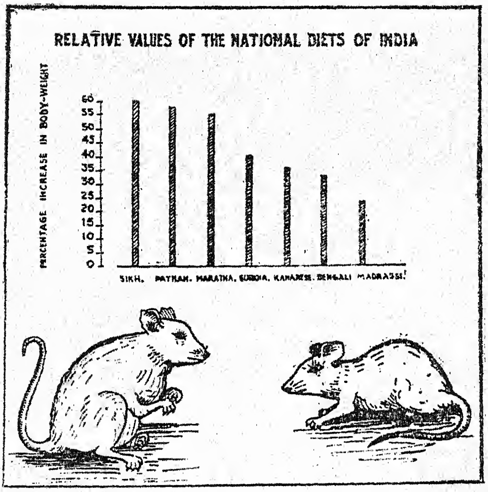
Major General Sir McCarrison, Director of Nutritional Research at Pasteur Institute, Coonoor, South India, in the evidence he gave before the Royal Labour Commission three years ago made the following memorable statement on the relation of food to the physical efficiency of Indian workers. " The level of physical efficiency of Indian worker is, above all else, a matter of food. No other single factor, race, climate, etc., has so profound an influence on their capacity to sustain arduous labour and prolonged muscular exertion. Nowhere in the world is this outstanding influence of food more conspicuously illustrated than in India. As we pass from north-west regions of the Punjab down to the Gangetic plain upto the coast of Bengal, there is a gradual fall in the stature, weight, stamina and efficiency of the people.

In accordance with this decline in manly characteristic, it is of utmost significance that there is an accompanying gradual fall in nutritive value of the dietaries, and more especially in the average level of Protein metabolism attained by the people of Punjab, United Provinces and Bengal." Lt. Col. D. McCay of the Indian Medical Service arrived at similar conclusions some years before, as a result of his nutritional researches.

Provincial dietaries of the people of India examined.

In order to find out the nutritional values of the diets of different races of India, Sir Robert McCarrison made extensive experiments extending over a period of three years. He fed rats on the dietaries of the following races–Sikhs, Gurkhas, Marathas, Pathans, Kanerese, Bengalis and Madrasis. As a result of his experiments he found that the percentage increase in the body weight of rats fed on the Sikh diet after 80 days, was the highest, i. e., 60, while that fed on Madrasi diet for the same period was found to be the lowest, i. e., 18.

A diagram showing the effect of food of different provincial dietaries on the rats is given below :—



Diet and height.

There is a close relation between the diet and the height of a race. The Japanese, the Chinese and the Javanese are short in stature, while Polynesians, the Northern Europeans, the Sikhs, the Punjabis and the Pathans are

tall. The taller races have hit upon the dietary conducive to a greater growth while the shorter races have fallen short of their standard. It was found by Japanese scientists that school-going children, who were given diet used by taller races, increased in height and weight and were found to grow taller by several inches than children fed on the normal diet of the country (Japan).

Scarcity of milk–one of the factors of the highest infant mortality in India.

A great Indian authority on milk problem has well pointed out, that the insufficient milk supply and the consequent rise in the prices of the milk is responsible for the appalling infant mortality in India, which is nearly double that of United Kingdom, Denmark and Japan; three times that of the Norway and Sweden; about five times that prevailing in Holland and U. S. A.; and nearly nine times that of Newzealand. It has been estimated that every year nearly 20 lacs of Indian babies die chiefly of mal–nutrition — certainly a state of things which can be easily prevented. Statistics show that the number

of milch cattle in India is insufficient and their yield of milk is poor both in quantity and quality. Most of the diseases of the children are due to lack of this most necessary nutrient food and yet people are not conscious of it. India is spending 15 crores of rupees every year for maintaining lame, diseased and dying animals at Panjrapoles but not even one per cent of that amount is spent after the improvement of the milch cattle. The result is that the animals become undernourished and the rate of infant mortality runs higher for want of nutritive milk diet.

Effect of food on cost of production.

Arno S. Pearse in his report on the cotton industry in India (1930) writes as follows:— "Operatives in Japan work as many machines as can be attended to under fair conditions, actually up to three sides of a spinning frame and 5·5 looms per operative against one side and less than two looms in India".

Though the wages in India per operative is much lower than those in England or Japan, yet the cost of production in India is much higher than that in Japan or England.

This is chiefly due to the poor efficiency of the Indian operatives. This again is due, among other causes, to the frail constitution of the operative the result of unsound feeding.

Population of India ill-nourished.

Major General Sir J. W. D. Megaw., the Director General of the Indian Medical Service, who recently made a special inquiry into the general health of the people of India has recorded the following conclusions :—

"Taking India as a whole the doctors regard 39% of the people as well nourished, 41% as poorly nourished and 20% as very badly nourished. The general conclusions derived from the survey are,

1. India has a poorly nourished population;
2. the average span of life is half of what it might be;
3. in spite of excessively high death rate, the population is increasing much more rapidly than the output of food and other commodities.

Ignorance, the root cause of India's sufferings.

It is not poverty alone but ignorance also which forms the root cause of India's misfor-

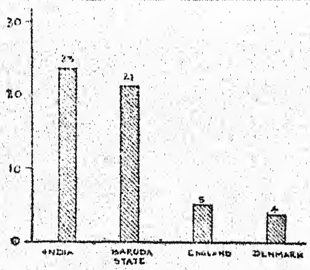
tune. The number of literate persons in India according to the Census of 1931 is 8% of the total population. Plato rightly said long ago that ignorance is the root of misfortune. Errors in eating, drinking, sleeping, dressing, house-construction, ventilation, light, accommodation, sexual associations, medicating and numerous other errors, whether sanitary, social, moral or religious, could be traced to ignorance. A knowledge and better understanding of the laws of life and health, knowledge of the laws of personal, general and moral hygiene, would speedily put an end to all India's sufferings.

Some of the evil social customs are deteriorating the physique of the people of India.

The lives of the bulk of the people of India are regulated by customs and traditions. The custom of early child marriage prevailing in some parts of India is leading to the progressive deterioration in the physique of the people, and is making them less capable for the struggle of life. How can we expect the children of early marriage brought up in insanitary surroundings, fed on a lot of nasty, indigestible food stuffs, clothed in careless

manner, educated in overcrowded schools, to enjoy the blessings of good health, longevity and prosperity ? How can we expect young girls overburdened with the responsibilities of home and motherhood at a tender age, to propagate a healthy and intellectual race of men and women ? Do not many of these poor girls die during child birth suffering the agonies of child labour and cursing their parents for having married them when they were very young and when they did not know what marriage meant ? A diagram showing the average death rate of mothers at the child birth in India comparing it with those of other countries of the world is given below.

DEATH OF THE MOTHERS AT CHILD BIRTH IN INDIA PER 1,000 COMPARED WITH THE OTHER COUNTRIES OF THE WORLD



Some of the defects in the Indian dietary and the result thereof.

I need not dilate further on questions like those referred to above. I am concerned mainly with food; and my investigations into the dietaries of the principal castes in the Baroda territory, made for the Baroda State Volume of Indian Census Report 1931 and Food Survey of the City of Baroda 1934, led me to the following conclusions :—

1. The dietaries differ quantitatively and qualitatively from community to community and from district to district.

2. The dietaries are deficient in proteins and fats of high biological value.

3. The dietaries are deficient in vitamins A, B, and D.

4. They are deficient in mineral salts of Calcium, Phosphorous and Iron.

5. In the case of vegetarians the diet contains excessive amount of starch and carbo-hydrates, which by their very bulk lower down the coefficient of digestibility. To satisfy the minimum requirements of the body they have to take food in maximum bulk.

6. Most of the dietaries are found deficient in vitamins A and C as majority of people do not take sufficient quantity of fresh fruits and raw vegetables such as tomato, radish, cucumber, cabbage, carrot, celery etc.

7. The dietaries are found deficient in the mineral salts of Calcium as many people consume very little milk and milk products.

8. On account of faulty cooking methods much of the mineral salts and vitamins are lost.

9. Meat on account of less sanitary control, is poor in quality and is productive of many diseases. Inspection of animals before slaughter is hardly undertaken. More than 70% of the animals brought to the slaughter house are half starved, old and diseased. Meat, therefore, of such animals is poor in quality and is productive of many diseases such as diarrhoea, gastro-intestinal irritation, pleuro-pneumonia, tuberculosis, foot and mouth diseases etc.

10. The non-vegetarians cannot afford to eat meat, fish and eggs every day.

11. The outer coverings of wheat and other grains are thrown off. Thus vitamins B and D are lost.

12. Water in which leafy and green vegetables are boiled is thrown off; thus many of the mineral salts are lost.

13. Faulty methods of storing grain account for many fungus diseases in them.

14. Milk, butter, ghee, oil, atta, which are the main items of nutrition in the vegetarian dietary are mostly adulterated.

15. Ghee which is one of the staple luxuries of an Indian home was, from the samples analysed, found to be adulterated with dolia or mowha oil, cotton seed oil, vegetable ghee and at times lard, margarine and foreign fat.

16. In India where majority of the people are vegetarians, milk is the only nutritous food for them. The conditions under which milk is produced and sold are filthy in the extreme. Its adulteration with impure water is a universal practice. In many cases cream is commonly removed to make butter

or ghee before it is sold, so that the milk available in bazar is not only adulterated but dirty skimmed milk. The contaminated milk therefore, becomes the carrier of infection of scarlet fever, typhoid fever, diarrhoea, dysentery and cholera.

17. The excessive use of tea, coffee and other stimulating drinks being harmful has led to the loss of appetite and has produced nervous diseases among the masses.

18. The excessive use of canned food products by the rich has been found to cause lead-poisoning.

19. The well-to-do vegetarian class take too much sweet-meats and excessive amount of fat in the form of ghee etc., in their dietaries which has led to the formation of sugar and they suffer from diseases like diabetes, obesity, heart troubles etc., while the well-to do non-vegetarian class take too much meat and suffer from uric acid which leads to rheumatism, kidney troubles and gout.

20. In the daily dietary most of the articles of food including vegetables are fried in oil which destroy vitamins in them.

21. Too much of chillies, spices and condiments are used by the people. They add but little to the nutritive value of food. On the contrary excessive use of them has done harm by producing acidity inflaming the mucous membrane of the stomach and the intestines and has caused dyspepsia, piles, fistula among the masses

The above results are also applicable with more or less degree to the other parts of India as well. The result of these deficiencies is a tragic tale of our great country. India has an average longevity of merely 24 years. India has 5 crores of widows creating their own social, moral and economical disturbances; she loses 10 lacs of adults and 20 lacs of children every year.

How to rectify these defects ?

In order to make up the above deficiencies it is necessary to add milk and milk products, fresh fruits, vegetables, (meat, fish and eggs if there be no religious objection) to the daily diet. But this is far beyond the means of the millions of people in India.

It is, therefore, essential to add to our daily diet some nutrient which will make up the above deficiencies and provide a balanced diet which would be within the reach of the poorest in the society. Such a nutrient is SOYA BEAN, as the reader will see from the chapter following.

CHAPTER II.

History of the origin and growth of Soya Bean.

Derivation of the word Soya Bean.

In the ancient Chinese Dictionary named "Kouangia" which was written about the time of the beginning of the Christian Era, Soya Bean is described as "Ta-teon" grand pea. Confucius, the great Chinese philosopher in his writings calls it "Shu". In the ancient Chinese books it is named "Sou". It is very likely therefore, that the names soy, soya and soja might have been derived from the ancient name "Shu" or "Sou".

Origin of Soya Bean.

Soya bean is a native of Eastern Asia. The plant formerly called "Glycine Ussuriensis" is still to be found in China, Korea, Manchuria and some parts of Japan. This wild plant is the ancestor of the present cultivated plant.

Literature.

In recent years soya bean has assumed such a great importance that many excellent articles, books and essays printed in different languages have appeared in widely scattered publications numbering about 1200 to 1300. Some thirty of them have been referred to in the bibliography at the end of the book.

Primitive man and soya bean.

Long before the dawn of civilization when history was not recorded, primitive man subsisted on wild soya bean. The cultivation of soya bean was not done by him as he had not passed then the nomadic and the pastoral stages, though he had made free use of wild seeds.

Name of the plant.

The soya bean plant is one of those plants which has got a confused botanical history. The fact being that Linnacus, in his book called "Specis plantorum" published in 1753, mistook mung bean for soya bean and this mistake has been perpetuated in botanical books. More light has been thrown recently on the

botanical history of the plant by Sir David Prain and other writers. Botanically it is now called Glycine Hispida. Under the international rule of botanical nomenclature it is called Glycine Max; while under the American nomenclature, it is called Soja Max.

Home of Soya bean and its expansion.

China, Korea, Manchuria, Mangolia and Japan are its ancient homes. But the cultivation of this Bean has now been extended to the United States of America, South Africa, Egypt, some parts of Europe, Russia, Australia, Dutch Indies, Philippine Islands, Indo-China, Malay, Archipalego, Siam, Burma, Nepal, Afganistan, Mirpurkhas in Sind, and some parts of Northern India.

The varieties of Soya bean.

Soya bean is included among the leguminous plants and some 1500 varieties have been known so far. Out of this upwards of 900 have been tested by the United States Departments of Agriculture during the last 10 years. Nearly 500 varieties have been introduced in America from China, Manchuria

and Japan and other Oriental countries. Several of these varieties have been cultivated successfully in America. Soya bean is shaped like an ordinary pea or bean. It is small in size. It assumes according to variety of seed many different colours such as green, black, yellow, brown etc. Some seeds have scar or hellum on them of different colours which distinguishes one variety from the other.

The culture of Soya bean is very remote.

Soya bean has been the chief article of diet in China for over 7000 years. More than 70 names are used in Oriental countries for soya bean and over 1400 varieties exist. This testifies that the plant must have been of very remote origin. Poems dating as far back as five thousand years are found praising this bean, its utilities and services to humanity. This is one of the most important plants which has contributed to the subsistence of that great and ancient civilisation of China. Soya bean being the staple article of diet in China, was planted every year with great regal ceremonies by the ancient dynasties of the Chinese

SHEN-NUNG.

The chinese emperor 2838 B. C. called "the heavenly farmer". He used to plant Soya bean every year with great ceremony.

Emperors. Soya bean has furnished a well balanced diet to the people of China and even the very existence of the Chinese nation can as well be attributed to this most important bean.

Reference of Soya bean in old Chinese records.

Soya bean has a literature of its own showing its ancient origin and existence. So far as we know, the reference of soya bean is to be found in Chinese *materia medika*, written 3000 years before the Christian Era. The Chinese Emperor Shen Nung who ruled China some 6000 years before described it himself in "Ben Tsao Gang Mu" the ancient *materia medika*, as the best food in those days. Emperor Shen Nung was one of the beloved rulers of his innumerable subjects; and to the internal pride of all farmers of the nations and of all ages this monarch was given the title of "Heavenly Farmer". According to the living Chinese authorities Li-Yu-Ying and Grandvoinnel, soya bean is described in the book of *materia medika* "She Non" written over 5000 years ago. The celebrated dictionary of Sui Sham describes

the plant under the name "Tehouan". Reference of soya bean is also to be found in the old literature of Japan, which shows that it has been cultivated in that country from times immemorial.

How and when soya bean became known to Europeans.

The first scientific study which made soya bean known to Europeans was published by Engelburt Eamfer, a German Botanist in 1712, who spent two years in Japan (1691-92.) He used the Chinese name "Daidsu" and described the plant as erect and bean like with pods like the lupine, and the seeds resembling the white peas. But soya bean did not come out of its obscurity in the West until the appearance of " Dic Sojabohne " a classical book on soya bean by Prof. Fredrich Haberlandt of the Vienna University. He drew marked attention of the European world to the importance of soya bean in this well known book. He exhibited 19 different varieties of soya bean plants and seeds at the Vienna Exhibition in the year 1873. It was by his persistent efforts that soya bean was introduced into Austria and Germany.

Soya bean in England.

In 1890 soya beans were grown in the Royal Botanical Gardens at Kent. But England owes a debt of gratitude to Mr. J. L. North, late curator of the Royal Botanic Society of London, for the adaptibility of soya bean on the English soil. He acclimatised four early maturing varieties which gave encouraging results. By careful selection, patient research and intelligent observation of the plant habits Mr. North eventually triumphed over innumerable difficulties and was able to raise in 1933–34 a successful field crop in England at Boreham Essex on the estate of Mr. Henry Ford. This was a great encouragement to English farmers and it was from this time in England's agricultural history that soya beans are grown as a field crop.

Mr. Henry Ford, the indefatigable captain of industry was encouraged in this experiment owing to the success in harvesting large crops of soya bean on his property near Detroit, (U. S. A.) and being convinced of its value as a soil improver and realising the by–products

obtained from the seeds he was anxious to grow the plant in England. He sent seeds from Michigan to Essex, for experimenting on 6 acre field, specially prepared on his estate in England. He harvested successful field crop in 1933–34.

Soya bean in France.

In 1739, the French missionaries in China sent some soya bean seeds from China which were planted at Garden–Des–Plants at Paris. In 1855, the Societe–de'–acclimation distributed numerous packages of soya bean seeds. In 1868 M. Chauvin cultivated several varieties of Cote de'or and the culture there has since then been continued. In 1880, Vilmorin Andrieux and Company introduced in France one of the varieties tested by Haberlandt in Austria. This variety is known in France as the yellow variety (Etamples), which is known as "Ito san" in America. This variety is found to be well adapted to French soil. Soya bean is now grown widely in France.

Soya bean in Italy.

The cultivation of soya bean began in Italy in 1840. At present it is assuming great

importance in that country. It is cultivated in Naples, Marches, Emilia and many other provinces of Italy.

Soya bean in other countries of Europe.

The name of Prof. Haberlandt stands prominent in the history of soya bean cultivation in Europe. In 1877, he acclimatised at Vienna the seeds from different varieties and distributed them to 148 co-operators in Germany, Austria-Hungary, Poland, Russia, Switzerland and elsewhere. The tests made in these countries with the acclimatised seeds gave very encouraging results.

Soya bean in United States of America.

Soya bean was introduced in the United States of America in 1840. The first mention of soya bean in American literature is made by Mease in the same year. Thomas Nutall in 1829, cultivated soya bean in the Botanical Garden at Cambridge Mass. In 1853, a mention was made of it by Earnest in American literature under the name of "Japan Pea" as follows:—

"'The Japan Pea' in which so much interest has been taken in this country for a

year or two past, from its hardihood to resist draught and frost, together with its enormous yield, appears to be highly worthy of attention of the agriculturists."

Soya bean was brought to San Fransisco and from there it was introduced into Illinois and Ohio. Perry Expedition in 1864, brought several varieties of soya bean from Japan. In 1878, Mr. Neilson obtained peas of several varieties at Vienna and Austria. These were from seeds sown by Prof. Haberlandt of Vienna. In 1896, the United States Department of Agriculture cultivated several varieties and among these may be mentioned 'Ito San, Mammoth, Yellow, Butter ball, Buck shot Guelph, Eda, Easy cook', etc.

From 1914 onwards, soya bean and its by-products were imported into U. S. A. on a large scale. The imports were 8,000 tons of oil, 900 tons of seeds, 1,500 tons of cake. Since 1920, the imports have increased to 56,000 tons of oil, 1,400 tons of seeds and 12,000 tons of cakes. Since 1921, U. S. A. has taken to sowing soya bean and so great is the progress done that by 1931 the home production stood at 4,00,000 tons.

India and Soya bean.

V. C. Andolle, in 1884 believed that the plant was of recent introduction in India. But the recent investigation of Hooper in 1911 and 1912, and of Woodhouse and Taylor, go to show that soya bean was cultivated from the borders of Afganistan eastward to Burma. Hooper records nine distinct varieties from India. Most of the varieties have small seeds, small pods and tender twining stems. India never much cared either to improve or to extend its cultivation though it has been grown for some time in Sind. It was only very recently that some stimulus is given to sowing yellow variety at Poona, Amroti, Bagalkot, Maroli, Bardoli, Broach, Pusa, Karachi Coimbatore, Baroda, Indore, Punjab and such other experimental stations. These experiments have shown that soya bean is a successful crop in India. Detailed results of some recent experiments are given in the Chapter on "The Cultivation of Soya Bean".

CHAPTER III.

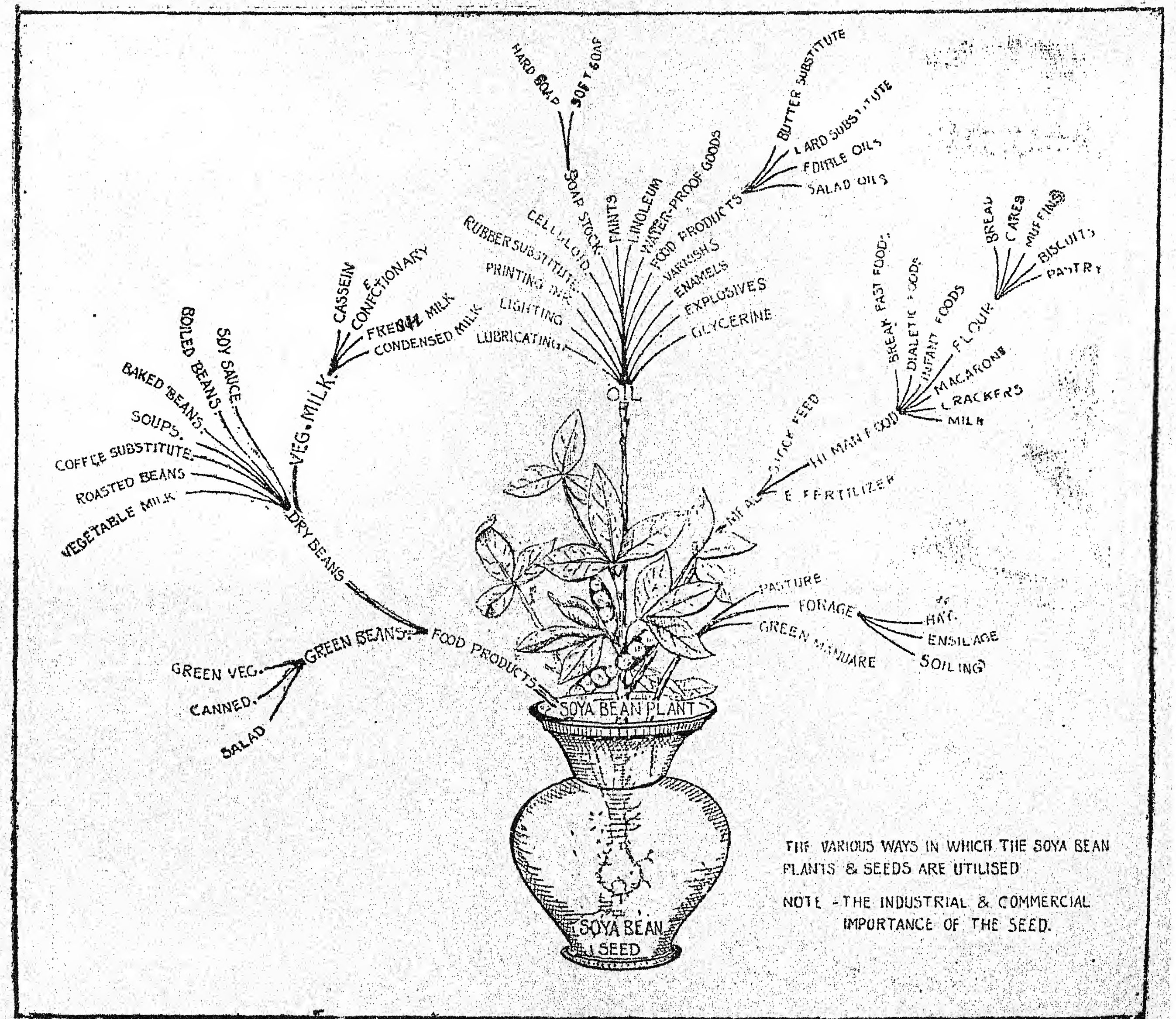
The use of Soya Bean.

Importance of Soya Bean.

In recent years great interest has been evinced in the cultivation and the use of soya bean, mainly on account of its dietatic, industrial and agricultural importance.

Dietatic importance.

The bean is very useful in the preparation of bread, buscuits, cakes pastries, soups, omelets, sprouts, Indian dishes like pulav, dal, chevda, shev, bhajias, usal and many other tasty dishes-Indian, European, Chinese, and Japanese. Soya bean is especially interesting to vegetarians on account of its richness in protein, fat, carbohydrates, mineral salts and vitamins. The analysis of soya bean given in the subsequent chapter shows that its protein is of a high biological value and resembles protein in meat, fish and eggs. The analysis, biochemical researches and feeding tests on rats show that soya bean contains



A chart tree showing the various uses of soya bean.

three vitamins A, B and D; when it is sprouted it contains vitamin C also. Soya bean is rich in the mineral salts of calcium, sodium, manganese and phosphorus in appreciable quantities.

Soya bean milk which resembles cow's milk in its properties and has been the main source of life for centuries in the oriental countries, namely, China, Korea and Japan.

Industrial importance of soya bean.

Soya bean is very useful on account of its industrial importance. It is used in the manufacture of lard, margarine, vegetable ghee, etc. It is also used in the manufacture of paints, varnishes, linoleum, water proof goods, paper umbrellas, printing inks, celluloid goods, glycerine, rubber substitutes, fire works and explosives.

The oil of soya bean contains lycethin and vitamin A and resembles butter in its properties. When there is a shortage of olive oil in the world markets soya bean is substituted for it.

It is an edible oil and is used by the people of China and Japan for cooking

purposes. It is also used in lubricating machinery.

Agricultural importance.

Every part of soya bean is useful. The forage is made into green manure, hay, ensilage and soiling. The milch cattle give more milk when they are given soya bean feed. In America, it was found that hogs when they are provided with soya bean feed, go on putting more and more weight.

After the oil has been extracted the resulting residue called cake or meal, is very rich in protein and mineral salts and is very valuable as fertilizer for the soil, as a feed for the live-stock animals, and as flour for human food.

Soya bean improves the soil on which it is grown like other leguminous plants; it takes its Nitrogen from the air, and not from the soil. It transfers the Nitrogen thus taken from the air into the soil, making it rich and fertile. It serves as a rotation crop. It improves the agriculture of the country and gives food to millions. It supplies fodder to the cattle and manures to the fields. Soya

bean is comparatively cheap and gives the maximum amount of energy at minimum cost.

America was the first country to recognise the importance of this plant and now soya bean is cultivated all over the States of America. Soya bean and soya bean flour can be had in every grocer's shop in America.

During recent years some European countries have taken to the cultivation of soya bean. They are England, France, Italy, Germany, Austria, Switzerland and the Balkan States.

In the " Five Years Plan" Russia has set aside vast tracts of land for the cultivation of soya bean. There is a soya bean Research Institute at Moscow. An exhibition of soya bean food was held where 300 varieties of soya bean dishes were prepared including cake, pastry, salads, biscuits, chocolates, toffee, tea, coffee, cutlet, meat substitutes, soup etc. It was served to the representatives of trade-unions, factories, engineers, Soviet Press, and the Red Army. The food was unanimously pronounced to be excellent.

In Italy Signor Mussolini has founded a Soya Research Institute to investigate into the possibilities of its introduction in that country. He has ordered a study of soya bean food values. It is said that in Italy soya bean flour is added to the rations of the armies and the breads containing 15 to 20 per cent of soya flour are made by the order of the Italian Government.

Medical Importance.

Soya flour is of great importance in diabetic dietary. Its starchy contents being quite negligible and its sacchides low, it is most suited to diabetic patients. Its carbohydrates are mainly such as to give energy without being provocative to the appearance of the sugar in the urine. This is why medical practitioners prescribe soya bean flour in the diabetic dietary. Dr. Jozef Szanto in his pamphlet on "Soya bean flour in the treatment of diabetes," writes that he used to give soya flour to the diabetic patients under his charge in his sanitorium with great success.

It is recognised by the medical profession that phosphates are very important for the

brain cells and nerves. Soya bean contains abundance of phosphates so that it can be used with advantage, for the cure of nervous diseases. Some medical authorities have used them for the cure of rickets, pulmonary diseases, anaemia etc. with great success. Dr. Levin of the Rockfeller Institute of New York, found in it another brain building substance called Cephalin.

Soya bean is alkalising in its effects.

Meat, fish, eggs, cereals and pulses produce acidity in blood tissues while soya bean is alkalising in its effects. Studies made by Osborne at Barbara's Hospital show that after a meal of soya bean the alkalinity of the blood is increased. Soya bean food nutralises the acidity in the blood. It is very important from the medical point of view as the normal alkaline state is the state of highest health and physiological functioning, while the acid state is pathological condition. Protein from meat increases the amount of uric acid in the system and thus creates rheumatism, kidney troubles and gout. The protein from soya bean on the other

hand neutralises uric acid and does not produce any disease. It is said that gout is unknown in China. Soya bean milk as well as its flour is used in food for invalids and infants, like Nestle's food.

Longevity and soya bean.

In China and Japan, Buddhist monks never eat meat. Protein in their dietary is supplied by soya bean and its products. It is statistically proved that they are the longest lived people in those countries.

The lecithin content of soya bean is high and so it makes a fair substitute for eggs. The medical science is unanimous in recognising the fact that lecithin is quite essential for building up the nervous system.

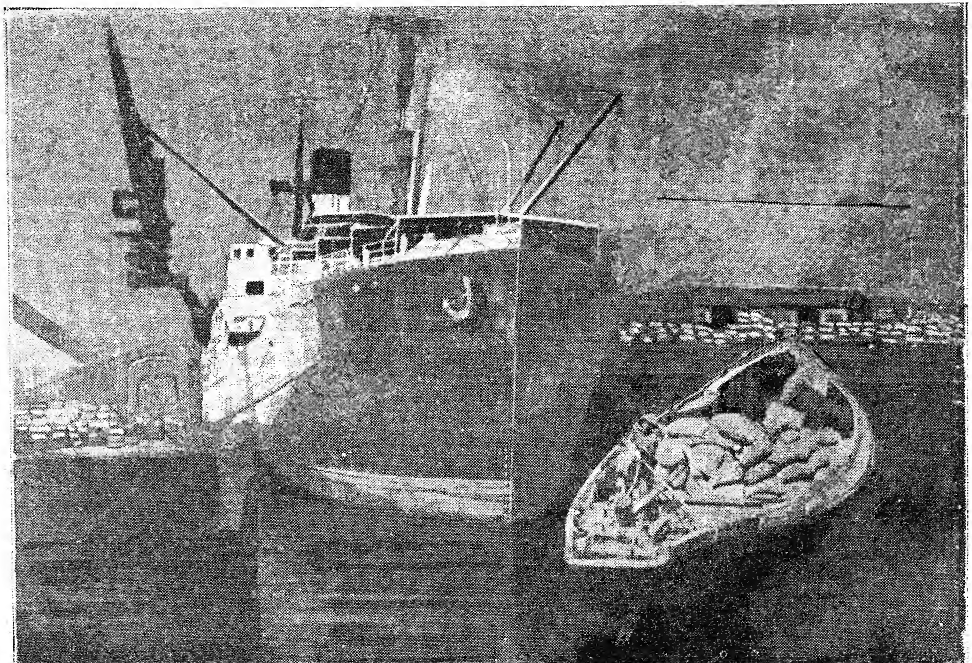
CHAPTER IV.

World trade in soya bean.

Before the Russo-Japanese war in 1904, soya bean trade was confined to Korea, Manchuria, China and Japan. Manchuria used to export surplus beans to Japan, but during the Russo-Japanese war, the demand for beans increased from Japan, as Japanese farmers were engaged in war. This naturally augmented the crop area throughout Manchuria. When Japanese troops were withdrawn after the war, the farmers returned to their fields. The surplus stock purchased during the war by Japan was lying with it. It became therefore, necessary for Japan to find some new markets. In the year 1907, Mitsui Bussan Kaisha & Co., made a successful trial shipment to England and since then the firm has been the leading exporter of Manchurian soya bean. The Manchurian staple is the one of many " finds " made by the firm. It so happened at this time that

the various European markets were short of linseed and cotton-seed. The oil mills in England and on the Continent, could not cope with the demand for the oils in sufficient quantities. Soya bean trial shipments were, therefore, welcomed by the English millers. The English and the Continental oil mills were not required to change either the process or the machinery for oil extraction. Moreover, the extraction of the oil obtained from the beans in Europe was in much greater proportion than that obtained in the country of its origin. The fact was that in Manchuria the old crude methods were used, while the European mills were equipped with the most modern machinery. The suitability of the seed for oil and oil-cakes was quickly recognised and orders for large consignments were placed with Japanese firms.

At first the oil was used only for technical purposes such as soaps, paints, varnishes etc. Afterwards it was found very useful as a food-stuff in the manufacture of Margarine, lard and other substances. Thus the trade extended to other countries in Europe. In



Soya Bean is ready for shipment at port Dairen (S. Manchuria).

The countries of the Orient where Soya Bean is successfully grown.

the beginning, England ruled the market due to the fact that soya beans imported were duty-free in England. A duty had to be paid on the soya bean consignment in France, Germany and other countries on the Continent. The Continental countries soon realised the disadvantages of imposing duty on imports of soya bean and so the import-duty was removed.

Comparative statistics of import of soya-bean in European countries.

	1908.	1928.
England.	62,000 tons.	1,75,547 tons
France.	21,390 „	1,05,431 „
Belgium.	11,750 „	...
Holland.	7,290 „	17,718 „
Italy.	4,140 „	...
Germany.	670 „	7,21,512 „
Norway. (1926).	7,076 „	Not known.
Denmark. (1927)	1,58,047 „	do.
Sweden. (1927).	71,321 „	do.

The above figures clearly show the growing increase in the import-trade of the soya bean in Europe after the duty was removed.

Over and above this, there is an increase also of import of soya bean oil and soya bean cake.

Production of soya bean in Manchuria.

At present Manchuria produces the largest amount of soya beans compared to all other countries put together. New Chwang was an important port of shipment for the great coastal trade in beans, bean cake and oil, along with ports of the southern provinces and Java, Sumatra, Singapore, and Borneo. During the past twenty years there has been an enormous increase in the production of soya bean as an important commercial product. The crop is seen from the shores of the yellow sea upto 47^0 of the Northern latitude. The further one goes to the north, the better quality of beans is obtained. The best reports have been received on the beans at Pehtwanlitze above port Harbine. The figures of Manchurian production in 1927 were :—

North Manchuria.	33,00,000 Tons.
South Manchuria.	23,50,000 Tons.
Total.	55,55,000 Tons.

Since 1908 the cultivation and the production of soya bean in Manchuria has been increasing year after year. In 1914, nearly 22,48,561 acres were under cultivation in North Manchuria while 10,82,496 acres were under cultivation in South Manchuria. The report of the American consul at Mukden for the year 1921 states that the production of the soya bean in Manchuria was 45,20,000 tons and in inner Mangolia the production was 4,31,000 tons. The following is the estimate of soya bean production in Manchuria, for different years taken from the report of British and American consulates at Mukden.

1914.	1921.	1927.
Tons.	Tons.	Tons.
11,50,000	45,20,000	55,50,000

NOTE:—The increase in production is due to the placing of large orders by European and American firms, due to the suitability of oil content and highly nutritious cake as manure and as food product.

The report of the Economic bureau of the south Manchurian Railway Company

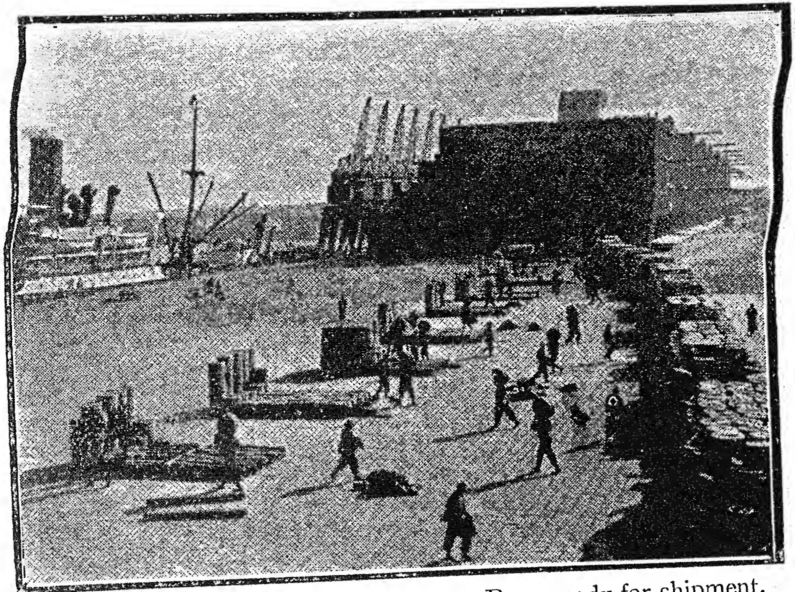
stated that the Manchurian production of soya bean amounted to 37·1 millions Koku equal to 5·88 million tons. Out of this production 2·6 million tons were produced in south Manchuria and 3·3 million tons in North Manchuria. According to the calculation of this bureau, Marakujew estimates the production of soya bean in Manchuria at 6 million tons aud that of the whole China at 16 million tons.

Export.

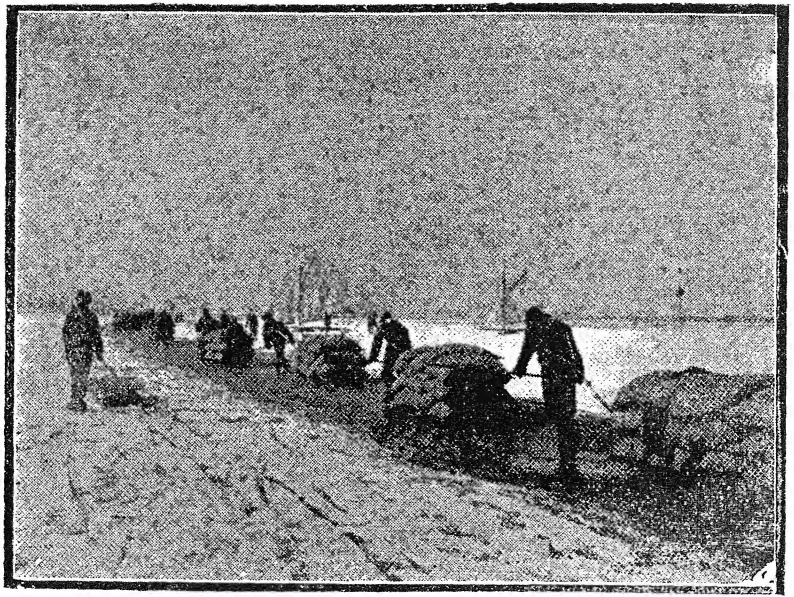
New Chang, Dairen and Autung are the principal ports of exports from southern Manchuria. The figures of export of beans to European countries in 1914, 1927, 1928, and 1933 were as follows:—

Name of the place.	1914	1927	1928	1933
		(figures in tons.)		
Diren.	1,69,300	1,151,787	1,220,683	1,550,000
Autung.	5,225	...	...	15,530
New Chwang.	1,05,341	...	...	3,00,000
Vladivostok.	...	910,000	...	1,500,000

The figures are compiled from trade report No. 115 p. 922 May 16th 1914 and other reports.



View of Dairen Harbour, bags of Soya Bean ready for shipment.



Transport of Soya Beans on the frozen Liao-ho near New-chwang (N. Manchuria).

This increase in the export of beans was due to the fact that the freight on the beans is much cheaper than that on the cake or the bean oil. It was found more economical, therefore, to shift the beans to Europe and America and to crush them there. For many years to come the prospects of bean export are much brighter.

Oil and cake industry in Manchuria.

In Manchuria the manufacture of oil and cake is not confined to large cities and towns; but even the small interior centres of bean production have their native oil mills, in which the oil is extracted by the primitive method. At Dairen 40 mills are working day and night during the season. They turn out every day 5,000 tons of cakes. There are two modern hydraulic mills newly established at Dairen which produce 4,000 tons of oil cakes per day. At New Chwang 22 mills are running.

In 1907 they turned out 18,662 tons of oil and 193,018 tons cakes.

In 1908 they turned out 21,328 tons of oil and 220,745 tons cakes.

In 1909 they turned out 23,994 tons of oil and 248,333 tons of cakes respectively.

The oil and oil cake industry in Manchuria is increasing very rapidly on account of the great demand from European and American markets. Denmark is a country of farmers; 150,000 tons of cakes were purchased for their cows from an English oil mill in 1910. Since then the trade is increasing and has extended to Sweden, Norway, Germany and Holland. The figures of the export of Soya bean cake from different ports from 1909 to 1928 are as follows:—

(Figures in tons.)

Ports.	1909.	1910.	1911.	1912.	1913.	1927.	1928.
Autung.	16,349	12,054	33,166	40,111	42,322	...	...
Dairen.	3,18,825	2,77,423	4,63,546	3,78,722	5,66,135	8,70,726	...
New Chwang.	3,56,499	3,27,098	3,86,599	2,82,877	2,98,364	...	...
Vladivostock.	...	...	...	...	...	...	4,73,000
Other parts.	...	...	...	...	...	...	3,50,000

Corresponding export figures for oils.

Figures in tons.

Ports.	1909.	1910.	1911.	1912.	1913.	1927.	1928.
Autung.	92	149	365	558	192	...	...
Dairen.	10,850	18,753	33,729	37,466	43,392	73,254	...
New Chwang.	37,875	21,356	28,039	21,822	28,752	...	...
Vladivostok.	...	...	...	...	...	...	23,000
Other ports.	...	...	...	...	...	...	...

Soya bean production in Japan.

Japan has always been a large consumer of soya bean. Having a local product of 18,163,000 tons, Japan imported 298,119 tons of beans from outside in 1927. Large amount of cake was also imported for manure. In 1927, Japan imported 1,176,000 tons of cake. Japan is also exporting every bean-oil and miso soy sauce in large quantities to America and Europe; in 1907, 6,863,953,000 lbs. of miso (bean cheese) and 13,210,743 lbs. of shoy sauce were exported valued at $700,000.

Soya bean production in America.

Soya bean was introduced in America in 1804. It had been grown as forage crop in the beginning. Now it is grown extensively for human consumption for oil and cake mauufacture. It is believed that soya bean will become one of the major crops of U.S.A. In 1910 the first consignment of soya bean was shipped from China for the purpose of the oil extraction. Leading grain journals report that the production of soya bean in U. S. A. was about 1,000,000 bushels in 1917. The estimates of production from 1925–33 were as follows:—

Year.	U. S. A.	Illonois.
1919	...	30,000 bushels.
1925	5,100,000 bushels.	...
1926	6,100,000 ,,	1,700,000 ,,
1927	7,900,000 ,,	2,300,000 ,,
1928	10,100,000 ,,	2,660,000 ,,
1933	17,300,000 ,,	5,700,000 ,,

The above figures do not include beans grown for forage or cattle feeding purposes. In spite of the rapidly increasing production large foreign imports of soya bean oil and cakes are still necessary.

Soya beans in Africa.

When the trade of soya bean began to increase rapidly in Europe and America, the demand for vegetable oil increased. English firms began to look to Africa as a source of supply. Extensive investigations were made of the possibilities of soya bean plantation and all the Government experimental farms in the Union of South Africa began to grow soya beans. It was proved that the crop could be grown successfully in the whole of South Africa. Government thought that introduction of soya bean would provide the material source of wealth to the farmers, dairy and live-stock and of some income to the Government railways, agricultural implement dealers and to oil and oil cake trade as well as allied trades. A regular seed crop as well as a rotation of soya bean crop has proved a complete success in Africa. At some Government experimental farms as high as 2,000 lbs. per acre of yield was recorded, while in many ordinary instances, it was over 1,000 lbs. per acre. Unfortunately, at some places in the Union the crop is subject to very wide fluctuations

owing to climatic conditions as late rains greatly restrict the area planted as well as deficient rain fall in the growing season, seriously reduces the yield. During recent years good crop of soya bean was obtained in 1921-22, about ten millions bags of 200 lbs. each, and over 24 millions bags in 1925-26 were obtained. The yield per morgan (2 acres) in good years, is 7½ bags. Owing to cheap native labour in South Africa it will be possible for them to compete with Manchuria in soya beans. In a few years to come South Africa will be one of the greatest competitors in the world market. At present maize is the most important agricultural crop in the Union. They are exporting large amounts of it to the foreign countries. In the year 1905 the crop was estimated officially at 240,000 tons against the wheat crop of only 200,000 tons.

Soya bean in Australia.

Experiments were conducted at Victoria and Queensland for growing soya bean plant as fodder for the cattle, and as seeds for the oil. The results obtained indicate that soya bean can be grown successfully for seeds as well as for fodder in that country. Australia

is a country of cattle and sheep. In 1927 owing to the prolonged draught many sheep and cattle perished for want of fodder. Soya bean will prove a good fodder and good feed for live-stock. It has been found by the Government Experimental station that soya bean crop will be successful if good seed and culture for inoculation were to be provided to soya bean farmers.

Soya bean in Europe.

Soya bean was grown in comparatively small quantities in the middle and southern European countries. In northern countries crop requires long season to mature, and yield is very low. However, climatic condition and soil for the cultivation in southern European countries are certainly favourable.

Soya bean in Java.

Cultivation of soya bean dates back to many centuries in Java but the crop is insufficient for the native demand. No less than 200,000 tons of bean have to be imported every year from Manchuria to cope with the need of the Javanese population.

The Javanese people do not give much care to plantation of soya bean or to improving the seed, which is very small. They sow soya bean in the field after paddy crop has been harvested. The beans are simply planted without the soil being cleaned of weeds. Even the weeding is hardly done except under absolute necessity. These soya beans are, therefore, small and cannot be delivered on usual soya bean contract.

Soya bean in India.

Soya bean in India has been grown for a considerable length of time on the borders of North West Frontier provinces and in Mirpurkhas in Sindh and in Nepal, it has been used as a forage and as food crop. However, India never concerned herself to improve the existing breed of cattle or in the expansion of soya bean trade. However it is a good sign for future that attempts have been made on some of the Agricultural Experimental Stations like Poona, Pusa, Sakkar, and Coimbtore, to sow some of the better varieties from Manchuria and America and as a result farmers are taking to sow soya beans in various districts though it will

H. H. THE MAHARAJA OF BARODA LECTURING ON THE DIETETIC AND INDUSTRIAL IMPORTANCE OF SOYA BEAN.

take some time to put it on commercial basis.

Soya bean in other British possessions.

Investigations are carried on in some of the above, regarding the plantation of the soya bean. It was found that the experiments were successful. The colonies would be able to compete very successfully, if chances are given to them by the Imperial Government.

Estimate of the world production of the soya bean.

The world produces 7,000,000 tons of soya bean of which Manchuria alone is credited with 5,500,000 tons. During the period of 1925–29 the yield of the cultivated crop was estimated by the leading firm of London soya bean dealers as follows:—

Name of the Countries.	1923–25. tons.	1926. tons.
China.	2,400,000	2,682,000
U. S. A.	145,000	165,000
Japan.	550,000	550,000
Java & Dutch East Indies.	...	...
Other Asiatic Countries & Africa.	...	...

1927. tons.	1928. tons.	1929. tons.
3,600,000	5,250,000	5,250,000
175,000	200,000	250,000
550,000	550,000	550,000
...	...	120,000
...	...	400,000

It may be noted here that there has been an increase in the world's production by 2,000,000 tons during three years in the above table. The increase of production of soya bean has hardly affected the price of this important product. The demand is keeping pace with the production. This means that it is getting more and more popular in the world's market. In 1927, the total crop of the oil seeds including soya bean was between 31,000,000 and 32,000,000 tons of which soya bean seed with the exception of cotton seed reached, the highest figures of 7,000,000 tons; from these statistics it is quite clear how important a part soya bean plays from the point of Agriculture, Industry and Commerce. Soya bean

is destined to take the lead of all the oil seeds known so far, in a few years to come.

The desirability of the expansion of soya bean cultivation.

The cultivation of soya bean on a large scale is still restricted to the countries of its origin, viz. China, Manchuria and Japan. America was first to know its importance and to introduce it and expand it in its limits. In all other countries capable of growing it, it is destined to become a successful crop, if efforts are made by the respective governments in co-operation with the people.

Imports of soya bean during
(International Institute of Agriculture, the

Name of the country	1919.	1918.	1917.
	(Figures in tons.)		
Denmark.	26,681·7	...	15,547·7
Holland.	16,365·2	...	1,976·9
United States.	2,184·3	716·6	2,672·1
Great Britain.	31,276·4	...	12,713·3
Japan.	85,651·8	58,086·6	47,097·1
France.	...	37·2	1,291·6
Russia.	...	...	...

1913 to 1919.

Bureau of Statistics 1921, pp. 368,369)

1916.	1915.	1914.	1913.
(Figures in tons.)			
49,498·1	52,373·9	37,317·3	24,034·4
2,194·5	8,275·5	9,809·3	13,777·1
1,501·5	1,918·9	964·7	...
33,206·4	86,821·3	36,151·4	38,839·4
36,603·0	59,411·9	53,415·5	64,862·6
668·4	77·7	...	22·4
...	2,274·5	2,849·1	1,930·4

Exports of soya bean in world's

(Figures from International Institute of Agricul-

Country	1919.	1918.	1917.
	(Figures in tons).		
China.	500,775·0	267,078·6	302,502·4
Japan.	330·3	361·7	766·5
Holland.	...	...	...
England (re: exports.	...	...	...
France.	6·3	0·5	...

trade. 1913 to 1919.

tural Bureau of Statistics, 1921, pp.368,369.)

1916.	1915.	1914.	1913.
(Figures in tons.)			
115,766·3	354,851·0	337,397·2	312,057·0
385·9	237·6	220·2	...
...	64·4	7,018·3	7,211·0
1,310·2	857·0	4,771·3	407·9
...	...	4·6	...

Imports of soya bean oil in the

(International Institute of Agriculture

Name of the country.	1919.	1918.	1917.
	(Figures in tons.)		
Great Britain.	15,079·6	302·8	1,779·1
Holland.	19,217·3	1,534·5	4,820·7
Sweden.	6,922·4	64·3	19·5
Canada.	2,774·3	4,580·1	2,502·5
United States.	44,408·3	76,199·5	60,083·8

world's trade, 1913 to 1919 inclusive.

Bureau of Statistics, 1921, pp. 420, 421.)

1916.	1915.	1914.	1913.
	(Figures in tons).		
...	...	...	...
5,297·0	9,653·2	5,088·2	1,436·9
3,400·4	4,399·1	2,440·8	2,115·2
1,216·2	961·2	863·4	1,033·1
32,978·1	4,838·7	2,847·4	3,225·3

Exports of soya bean oil in the

(International Institute of Agriculture

Name of the Country.	1919.	1918.	1917.
	(Figures in tons.)		
China.	71,383·9	68,830·8	57,169·0
Japan.	876·0	1,473·4	1,657·4
Denmark.	1,727·1	33·2	1,971·4
France.	7·3	0·4	11·7
Great Britain.	527·8	...	308·9

world's trade, 1913 to 1919.

Bureau of Statistics, 1921, pp. 420, 421.)

1916.	1915.	1914.	1913.
	(Figures in tons.)		
47,323·8	30,768·8	38,361·9	14,865·9
1,774·0	536·9	539·3	426·
155·5	3,063·6	3,529·9	1,939·9
4·4	...	...	...
2,313·5	6,844·6	4,735·3	4,770·3

SOYA BEAN.

Japan-Import and

Year.	Import.	
	Tons.	Value in £
1923	1,225,000	9,500,000
1924	1,100,000	9,000,000
1925	1,000,000	8,833,333
1926	1,250,000	10,625,000
1927	1,176,000	9,312,500
	IMPORTS INTO ENGLAND.	
	Soya beans	
1923	113,062	1,270,833
1924	111,474	1,333,333
1925	161,997	1,937,500
1926	46,358	520,833
1927	83,121	875,000
1928	175,547	2,062,500
	IMPORTS INTO FRANCE.	
1923	176,542	2,000,000
1924	31,603	375,000
1925	8,412	104,166
1926	6,650	83,333
1927	105,431	1,104,166

Export of Soya Cake.

Export.		Import Surplus.	
Tons.	Value in £.	Tons.	Value in £.
...	...	...	...
9,848	83,333	1,090,152	8,916,666
9,108	83,333	990,892	8,750,000
13,554	125,000	1,236,446	10,500,000
...	...	...	...
Soya Oil		Soya Cake.	
23,606	812,500	1,429	...
29,550	1,083,333	2,021	...
29,510	1,166,665	3,006	...
48,379	1,666,666	504	...
53,525	1,770,833	...	...
...	...	...	...
3,103	104,166	...	...
4,968	187,500	...	...
7,683	291,666	...	...
7,021	250,000	...	...
11,216	391,666	...	...

SOYA BEAN.

Year.	Import.	
	Tons.	Value in £.
	IMPORTS INTO GERMANY.	
1923	88,609	1,000,000
1924	137,331	1,666,666
1925	336,192	4,020,833
1926	370,038	4,083,333
1927	576,096	6,041,666
1928	721,512	8,479,166
	IMPORTS INTO HOLLAND.	
1923	16,682	187,500
1924	19,008	229,166
1925	36,497	437,500
1926	18,912	208,333
1927	9,937	104,166
1928	17,718	208,333
	IMPORTS INTO NORWAY.	
1923	10,313	125,000
1924	4,365	62,500
1925	7,076	83,333
1926	...	...
1927	...	...
1928	...	...

Soya Bean.

Export.		Import Surplus.	
Tons.	Value in £.	Tons.	Value in £.
26,437	916,666	...	...
19,126	709,166	...	...
33,472	1,333,333	...	...
19,685	666,666	...	...
11,290	375,000	...	...
10,483	333,333	...	...
29,863	1,020,833	21,471	208,333
30,526	1,125,000	30,991	333,333
38,461	1,520,833	32,121	356,166
49,763	1,708,333	25,486	270,833
75,472	2,416,666	27,354	270,833
35,564	1,145,833	29,360	312,500
2,398	83,333	...	...
2,209	62,500	...	...
2,550	104,166	...	...
2,438	83,333	...	...
3,568	125,000	...	...
...	...	...	...

Soya Bean.

Year.	Import.	
	Tons.	Value in £.
	Imports into Denmark.	
1923	128,921	1,458,333
1924	156,567	1,875,000
1925	108,388	1,291,666
1926	174,678	1,916,666
1927	158,047	1,666,666
1928	...	...
	Imports into Sweden.	
1923	60,105	687,500
1924	54,231	666,666
1925	72,763	875.000
1926	68,415	750,000
1927	71,321	750,000
1928	...	...
	Imports into U. S. A.	
1923	...	...
1924	...	...
1925	...	...
1926	...	...
1927	...	...
1928	...	...

SOYA BEAN.

Export.		Import Surplus.	
Tons.	Value in £.	Tons.	Value in £.
3,397	125,000	13,008	125,000
2,709	104,166	13,432	125,000
4,401	166,666	18,718	208,333
1,038	41,666	21,178	229,166
2,034	62,500	24,010	229,166
...	...	...	...
5,184	166,666	...	...
4,094	145,833	...	...
4,478	166,666	...	...
5,767	308,333	...	...
3,572	125,000	...	...
...	...	...	...
18,607	645,833	31,224	291,666
4,074	145,833	47,085	479,166
8,700	333,333	27,802	270,833
13,710	479,166	42,869	457,333
6,656	229,866	...	...
...	...	...	...

SOYA BEAN.

Export from China.

Years.	Soya beans.	
	Tons.	Value in £ 1,000.
1923	1,104,431	10,000
1924	1,486,520	14,333
1925	1,245,542	11,937
1926	1,364,061	12,020
1927	1,603,240	13,458

Soya oil.		Soya cakes.	
Tons.	Value in £ 1,000.	Tons.	Value in £ 1,000.
128,579	3,520	1,587,756	12,333
128,249	3,770	1,364,910	11,166
120,259	3,791	1,249,080	11,000
161,242	4,416	1,575,103	13,375
149,303	3,958	1,471,970	11,666

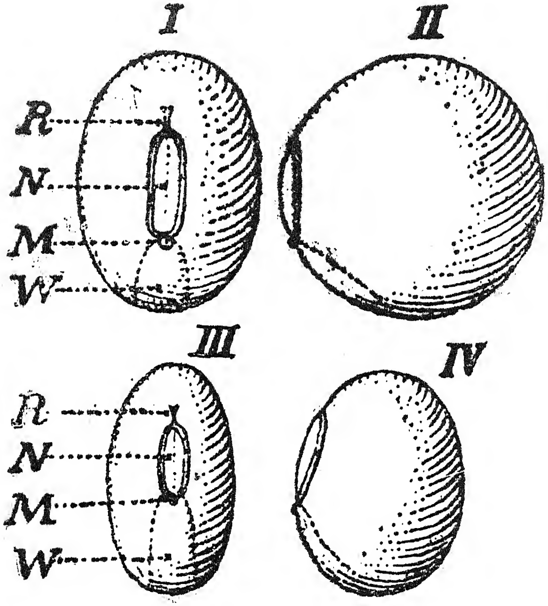
Japan–Import and Export of Soya Beans.

Year.	Import.		Export.	
	Tons.	Value in £ 1,000	Tons.	Value in £ 1,000.
1923	427,528	3,875	2,493	21
1924	426,464	4,104	2,364	20
1925	430,407	4,125	2,224	10
1926	431,261	3,708	2,225	10
1927	298,119	3,333	2,936	23

Import surplus.		Export from Korea.	
Tons.	Value in £ 1,000.	Tons.	Value in £ 1,000.
425,035	3,854	167,412	1,520
424,100	4,083	183,307	1,666
428,183	4,104	130,203	1,250
419,035	3,687	183,960	1,625
395,183	3,312	190,149	1,604

Japan Import and Export of Soya oil.

Year.	Import.		Export.		Export Surplus.	
	Tons.	Value in £	Tons.	Value in £	Tons.	Value in £
1923	471	...	2,589	83,333	2,118	62,500
1924	85	...	4,179	125,000	4,094	125,000
1925	15	...	7,180	229,166	8,598	229,166
1926	58	...	8,656	229,166	8,598	229,166
1927	52	...	5,025	145,833	4,973	145,833



—Soybean seed. I, II. A yellow variety from Japan. III, IV. Another variety. *N*, hilum; *R*, chalaza; *M*, micropyle; *W*, outline of hypocotyl seen through the testa. (*After Kondo.*)

Structure of soya bean seed.

CHAPTER V.

Botany of soya bean plant.

Main features of soya bean seed.

Many scientists have studied the structure of soya bean seed. The different tissues, of which the seed is composed of, are like those of the other beans but the cells containing oil are much different. It is very easy to detect therefore, the soya bean flour in mixture with any other commercial products. If examined microscopically, the "I" shaped cells are very distinctive. The presence of the protein cells in the seed coat is very characteristic. The absence of starch distinguishes soya bean from any other grains.

Scientific investigations.

The microscopic structure of the soya bean seed has been examined by many investigators; among them may be mentioned Harz in 1885, Wallis in 1913 and Kondo in 1913.

Microscopic structure of seed coat.

The seed coat is of three layers of cells, namely, the palisade cells, the hour glass or the column cells, the spongy parenchyma, and the aleurone layer.

Microscopic structure of the hilum.

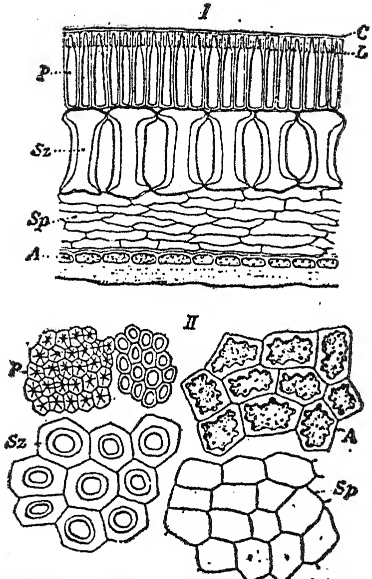
The cellular structure of the hilum consists of double outer layer of palisade cells, the fibro-vascular bundle, the loose parenchyma of star shaped cells.

The seed coat.

The seed coat is smooth, often shining, rather firm in texture and closely enveloping the embryo. The hilum (seed scar) is elliptical in shape and nearly flat. At the end, is a small linear grove making a point where the seed coat is joined to the body of the ovule. At the end of the seed scar is the micropyle–a minute orifice in the seed coat through which the primary root of the young seedling emerges in germination.

The embryo.

The embryo consists of two thick cotyledons or seed leaves. If these be separated,



I. Cross-section of the testa of a yellow soybean. II. Horizontal section of same. *C*, cuticle; *L*, light-line; *P*, palisade cells; *Sz*, hour-glass cells; *sp*, spongy parenchyma. *A*, aleurone layer. (*After Kondo.*)

Cross section of soya bean as seen through the microscope.

there remains clinging to one cotyledon and the remainder of the young plant consists of cylindrical hypocotyl, whose root is at the micropyle. At the other end is the primary leaf, bud or plumile. In germination, the hypocotyl elongates forming the primary root; while the other end makes the portion of the stem which pushes the cotyledons into the air. The after growth of the stem proceeds from the plumile.

Microscopic structure of the cotyledon.

The two cotyledons make up the greater part of the embryo. The epidermice of both surfaces consists of small cubical cells filled with grains of aleurone. The majority of the cells of the cotyledons are palisade in form, thin-walled and filled with aleurone and oil. The aleurone grains are spherical in form and between them is oil. In many of the cell crystals of calcium oxalate are found.

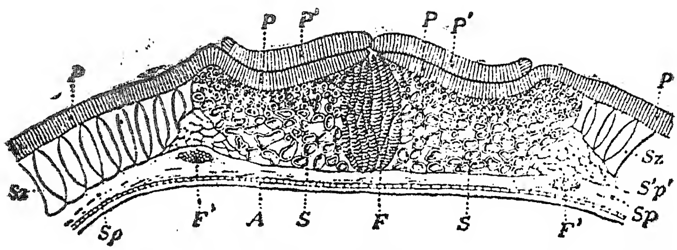
Botanical investigation.

Engelbert Kamfer was the first scientist who made soya bean known to Europeans after his two years' stay in Japan 1691–92. Paul Hermann in 1926, collected the plants in Ceylon and described them as a species of

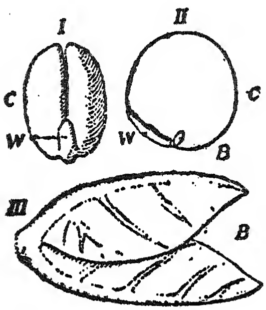
mung bean with villose hairs. This species is still preserved. It is nothing but the soya bean. Mr. Dale, the English Botanist began to investigate soya bean in 1905. Dr. Linnacus published a book "Hortus cliffortianus" in 1737. The plants described therein were those that were cultivated in Cliffords garden at Hattecamp, Holland. Soya bean was one of the plants described in the book. Dr. Rumphius, a Dutch naturalist, described and illustrated the plants of the Dutch East Indies in a book called "Hebarium Amboinense" in 1747. His description and illustration of the plant called "Cadelium" is very clearly the description of the plant soya bean. Dr. Rumphius gives the native name 'Kadellie' and states that the plant is to be found in Java and Malayan Islands.

Dr. Linnacus confused mung bean with soya bean.

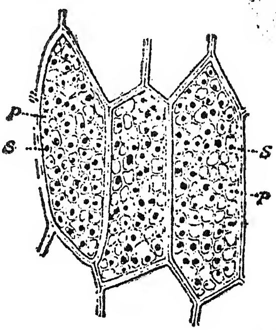
Dr. Linnacus' "Species plantorum" was published in 1753. He described two plants, one of which he called "Phaseolus Max" and the second "Dolicho Soja". Dr. Linnacus cited description of mung bean from other writers which he mistook for soya bean.



--Cross-section of hilum of a yellow soybean from China P', outer palisade layer; P, inner palisade layer; S, asteroid parenchyma; Sp, spongy parenchyma; F', fibro-vascular bundle; F, fibro-vascular bundle of the testa; A, aleurone layer; Sz hour-glass cells. (After Kondo.)



—Embryo of a yellow soybean seed from Japan. I. Whole embryo from the ventral side. II Half of embryo seen from the inner side III The two leaves of the plumule. C. cotyledons W hypocotyl; B. leaves of plumule (After Kondo.)



—Soybean. Cells of the cotyledon filled with fat, protein and starch; P, protein S. starch. (After Kondo.)

Cross section of hilum, embryo and soya bean cell as seen through the microscope.

Sir David Prain's elucidation.

Sir David Prain's investigations in 1897 cleared up the doubt and he definitely stated that Linnacus really intended the name Phaseolus Max to apply to mung bean and not to soya bean.

Piper and Morse's final decision.

Siebold and Zuccarani in 1843 named the plant as Glycine soja, supposing it to be Dolichos soja of Linnacus. This plant was not the cultivated but the wild plant later described by Regal and Mack in 1861 as "Glycine Ussuriensis." In most of the works it is described as "Soja Hispida (Moench)" while others give it the name "Glycine Hispida (Maximouiez.)" The use of the either of the names is based upon the fact that Glycine soja, cultivated soya bean (Siebold and Zuccarini) and Glycine Ussuriensis, the wild soya bean (Regal and Mack) are two different species. But in 1910, Piper and Morse have shown that this view point is not tenable, as the cultivated and the wild plants but represent one and the same species. In the beginning the cultivated plant was named Dolichos

Soja, but as the specific name soja was used later by Siebold and Zuccarini for the wild plant, it has since then been used in that sense.

Reduction of scientific names to binomials.

With the recognition of the fact that there is but one species and not two, the name "Glycine soja" as described by Siebold and Zuccarini for the cultivated plant, must give place to that of Max. Soya bean was named "Soja Max" by Piper in 1914. Other botanists called it "Glycine Max." Merril; thus the name Glycine Hispida has given place to Glycine Max. Linnacus in his "Species Plantorum" reduced all scientific names to binomials i. e. two words, while nomenclature of previous botanists was composed of more than two words.

Botanical synonyms of soya bean by various writers.

The following are the botanical synonyms of soya bean by various writers :—

(1) Phaseolus Max.	Linnacus.
(2) Dolichos Soja.	,,
(3) Soja Hispida.	Moench.
(4) Soja Japonice.	Savi.

(5)	Glycine Soja.	Siebold and Zuccarini.
(6)	Soja Agustifoba	Miquel.
(7)	Glycine ussuriensis.	Regal and Mack.
(8)	Soja Max	Piper.
(9)	Glycine Max.	Merrill.

CHAPTER VI.

Classification of Soya Bean.

Manchurian classification.

There are 1200 to 1400 varieties of soya bean. Of these, more than 700 have been tested by the United States Department of Agriculture and many of them have been successfully established in America. They are divided into the following three distinct groups according to their colour :—

1 *The yellow group.*

(a) Pai mei–the yellow seed with white scar.

(b) Chin huan–the round seed with yellow golden scar.

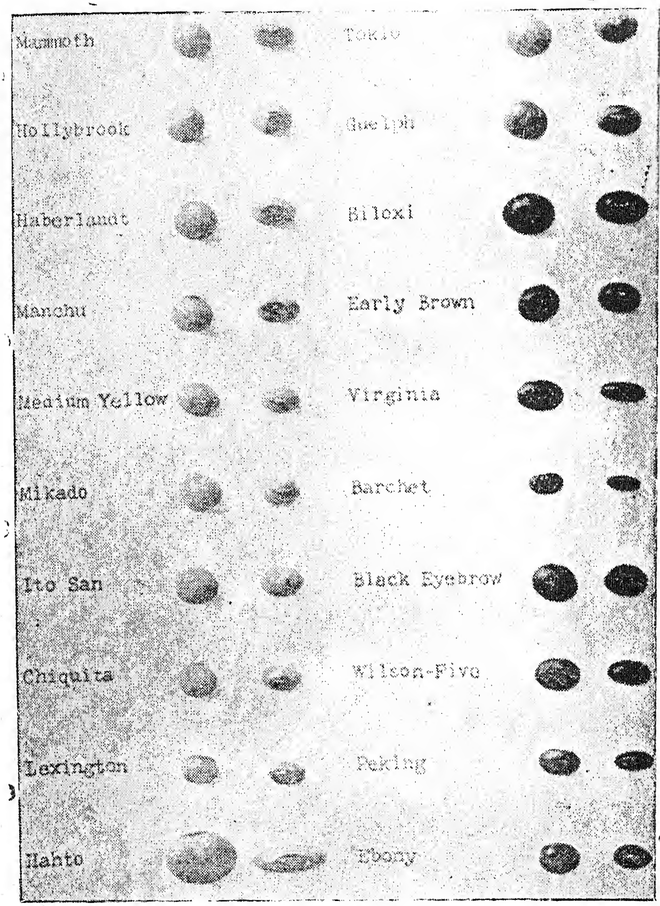
(c) Hei chi–the yellow seed with dark brown colour.

2 *The black group (Wu–tou).*

(a) Tu wu tou-the large black seed.

(b) Pieu wu tou–the flat black seed.

(c) The small black seed.



Different varieties of soya bean seeds.

3 The green group.

(a) Epidermis green but germ yellow.
(b) Epidermis and germ both green.

Japanese classification.

In Japan, the classification of varieties is made according to shape, size, colour, period of maturity and the uses to which it is put.

Marten's classification.

Marten in 1869 classified the varieties according to the form or shape of the seed

(a) Soja elliptica or the oval seed.
(b) Soja sperica or the round seed.
(c) Soja compressa or the compressed seed.

Harz's classification.

Harz divides soya bean seed into two distinct groups according to the form of the pods.

(1) Soja Platycarpe. Flat podded soya bean.
(2) Soja Tumida, swollen podded soya bean.

The characteristics of the different varieties of soya bean.

(a) The habit and growth of the plant.

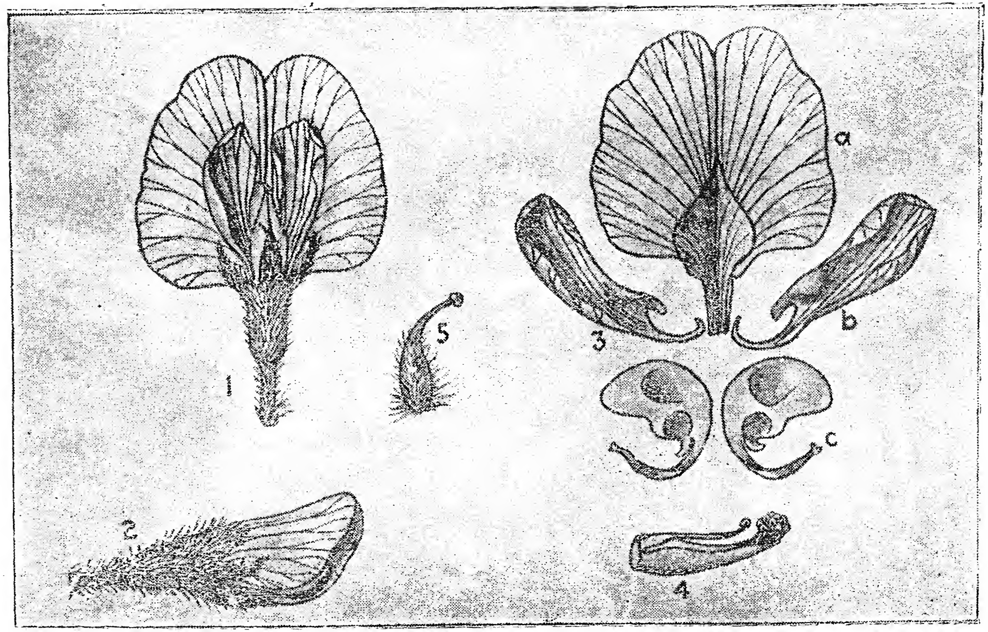
The soya bean plant reaches a particular height and size; then it matures and begins to wither. A great majority of varieties are erect, and branching with a well defined main stem. The branches may be short or the lower ones elongated. In other varieties the stem and branches especially the elongated terminals are more or less twining and usually weak so that the plant is sub-erect.

(b) Foliage.

A great variation occurs in the leaves of soya bean, in respect of shape, size and colour. They vary in length from 1 inch to 5 inches. In colour they are usually pale green. In all varieties of soya bean, the leaves begin to turn yellow, as the pods begin to ripen, and mostly all fall off when the pods are matured.

(c) Pubescence.

All soya bean plants are hairy and there exists but little difference in the amount of hairiness. No smooth variety has thus been found.



The Buds flowers and petals of soya bean.
1 Front view. 2 Side view. 3 Parts of the corolla. a, Standard; b, wing; c, one of the keel petals. 4 Stamens. 5 Pistil.

(d) Flowers.

The soya bean flowers are of purple and white colour. They have no odour. The flowers are borne of short azillary or terminal racemes, commonly from 8 to 16 in cluster. In some varieties the racemes may have as many as 35 to 45 flowers.

(e) Pods.

In most varieties of soya bean, the pods are compressed; in some cases they are cylindrical. The number of seeds in a pod in most cases is 3 to 5. Soya bean pods are commonly borne in clusters of 3 to 5. In others the cluster may contain as many as 18 to 15 pods. A single plant may bear over three hundred pods. The colour of the pods may be gray, straw yellow tawny or black.

(f) Size of the seeds.

The shape and size of the seeds vary according to the variety. Some are globose, some are elliptic and some others compressed.

(g) Colour of seeds.

Most of the varieties have the unicoloured seed, such as yellow, pale yellow, olive yellow,

green olive, brown and black. Bi-coloured seeds occur in a few varieties. The hilum or seed scar may be of the same colour as the seed-coat or it may have a different colour.

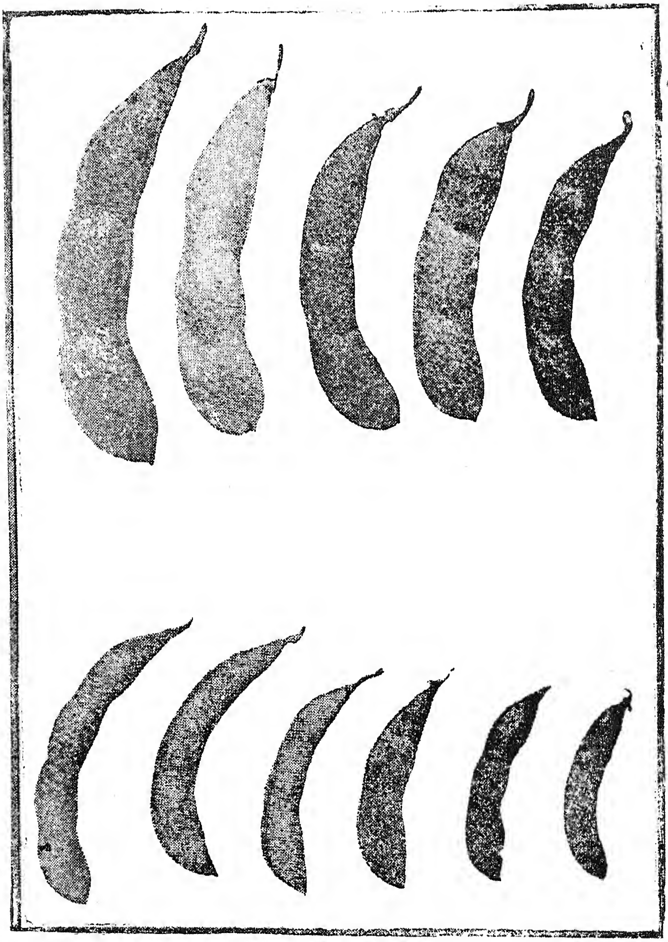
(h) Period of maturity.

There are some varieties maturing as early as in 75 days and others as late as in 150 days. With very few exceptions, the earliness is co-related to the size, the tallest being the latest. The results of tests performed at the Erlington Experimental Farm are given below:—

Very early	80 to 90 days.
Early	90 to 100 days.
Medium early	100 to 110 days.
Medium	110 to 120 days.
Medium late	120 to 130 days.
Late	130 to 150 days.
More late	More than 150 days.

Soya bean seeds mature early in India.

In the tropical climate of India soya bean matures earlier than in colder zones. The mammoth yellow variety was grown in some parts of the Baroda State, and the reports received from the cultivators show that



Different varieties of soya bean pods.

the period of maturing was from 80 to 95 days, while the same variety takes from 120 to 130 days to mature in America.

Soya bean is frost-resisting.

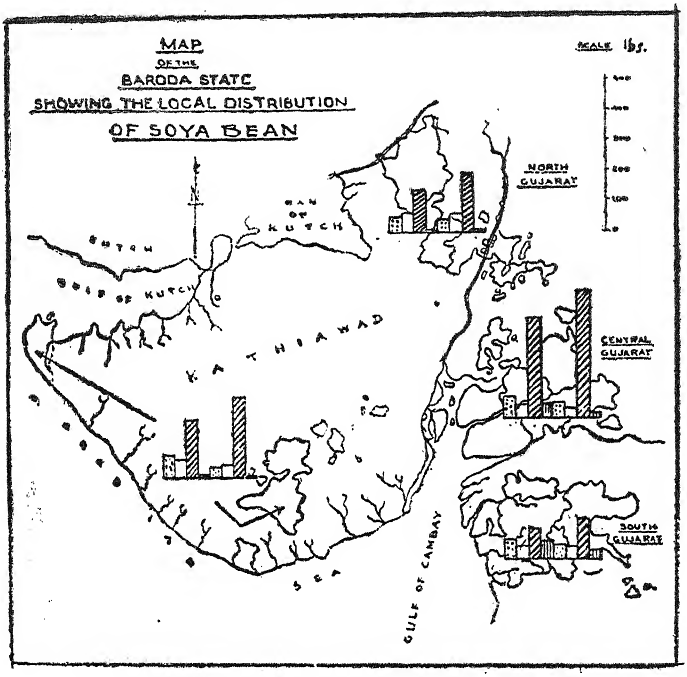
In Gujerat as well as in some other parts of India, frost is of common occurrence. In the year 1934, frost completely destroyed cotton, tobacco, tuver, juar, etc., but from the reports received from the farmers, it was found that soya bean crop was not much damaged. Even at Arlington Experimental farm, Washington D. C., where the first crops fell in 1909 the minimum temperature being 31° F, the top leaves of almost all the varieties were slightly touched, but no perceptible damage was done to any variety. In the variety-trial, at Muskegon Mich, in 1909, the Guelf, Ito San, Ogemaw, Haberlandt, Kingston, varieties were found to be frost-resisting.

A description of the Mammoth yellow variety in India.

The mammoth yellow variety, which has been acclimatised in the State Experimental farms, as well as by the farmers all over Gujerat, is specially selected for its greatest

yield in protein and oil. It is described as follows :—

Plants–stout, erect and bushy, maturing in about 90 days, pubescence gray, flowers white; taking 45 to 55 days for flowering: pods 34 to 45 mm. long 9 to 10 mm wide, 7 to 8 mm thick, three seeded; seeds straw yellow, 7 to 8 mm. long, 6 to 7 mm. wide, 5 to 6 mm. thick; hilum tawny, germ yellow: oil 18·6 p. c., seeds numbering 128,750 to a bushel.


MAP
OF THE
BARODA STATE
SHOWING THE LOCAL DISTRIBUTION
OF SOYA BEAN
SCALE lbs.
NORTH
GUJARAT
CENTRAL
GUJARAT
SOUTH
GUJARAT
KUTCH
GULF OF KUTCH
KATHIAWAD
SEA
GULF OF CAMBAY

CHAPTER VII.

The cultivation of soya bean.

Soil requirements.

Soya bean grows nearly in all types of soils. But the best results are obtained in sandy and clay loam soils, containing a fair amount of potash, lime and phosphoric acids. In Manchuria, it is seen flourishing even in sandy soils. In the United States of America it is successfully grown in the fields where corn and cotton is grown. In South Africa it is successfully raised on soils best adapted for wheat. In Europe good results are obtained on a variety of soils. Indian soils are found to give a remarkable response to this crop. At Sakarkand in Sindh, it is grown very successfully in semi-black soil; good results have been obtained in the Goradu as well as black soils in Baroda Territory. In medium black soil as is generally found in Poona, Satara and Nasik districts, good results

can also be expected. In the South and North of India similar results can also be had. The variety test performed in the United States Agricultural Experimental Stations goes to prove that soya bean succeeds in almost all types of soils.

Climatic considerations.

It is a plant most suited to warm temperature or temperate regions. Very severe winter and excessive heat are detrimental to its growth. That is why in some parts of Northern Europe its cultivation is not a success. The tropical regions with scorching sun burning every thing underneath are also not favourable for the growth of this crop.

Preparation of the soil.

Soya bean like corn responds to any extra soil preparation. The field where soya bean is to be sown as chief crop is ploughed deep early in summer and exposed to the sun few for a days. It is then harrowed twice or thrice at intervals in order to break the lump of soil. The field is then levelled by

means of planks thus bringing the soil into the finest possible tilth for planting.

The time for planting.

Soya bean can be sown in any season. It is a summer as well as a winter crop. But the best season for planting is the rainy season. It should be planted after the 15th of June when the first few showers of rain have fallen. In Gujarat the planting can be done a little late as there is a danger of Katras, i. e. hairy caterpillars in the beginning of the monsoon. In the hilly regions of India where there is a danger of severe frost, planting should be done after that danger is over.

Methods of planting.

Soya bean should be planted in rows. It should be sown generally through seed drill. In some parts of India where cultivation is on a very small scale hand sowing may be resorted to.

Spacing.

The distance between two rows should be from 24 to 36 inches. In order to facilitate easy cultivation 36 inches of width between

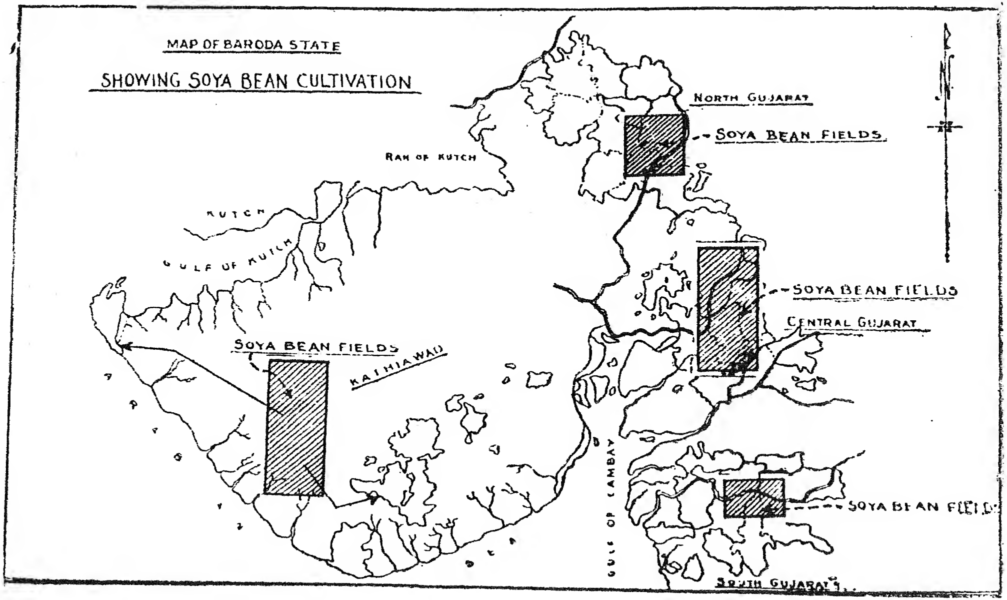
two rows is found to be the best. In China and Manchuria, soya beans are planted at a distance of 17 inches, and the plants about two inches apart in the row. According to Indian conditions the distance between the two plants in a row may be from 3 to 4 inches.

Seed rates.

From 16 to 20 lbs. of seed is taken as the average seed rate per acre, in the interior of Manchuria. But near river side and valleys half of the seed is sufficient. When the crop is required for hay or green manuring 40 to 60 lbs. per acre is the common seed rate.

Depth of seeding.

Too deep planting is non congenial for food crop. The depth should not exceed 2 inches in the heavier types of the soil. The chance of failure due to the formation of soil crust is lessened with shallow planting. The depth of seeding varies with varieties. The following table will throw light on the importance of seeding at different depth. At Arlington farm, Virginia, an experiment was made with Mammoth Yellow and Peking varieties 100 seeds of each variety were planted



MAP OF BARODA STATE
SHOWING SOYA BEAN CULTIVATION
RAN OF KUTCH
KUTCH
GULF OF KUTCH
SOYA BEAN FIELDS
KATHIAWAD
NORTH GUJARAT
SOYA BEAN FIELDS
SOYA BEAN FIELDS
CENTRAL GUJARAT
GULF OF CAMBAY
SOYA BEAN FIELDS
SOUTH GUJARAT
N

at different depths. The germination results were as follows:—

Variety.	1″	1½″	2″	2½	3″	4″.
Mammoth (Yellow).	100	93	98	95	92	84
Peking.	95	97	92	92	90	86

NOTE :—The depth of one inch in the case of Mammoth yellow and one and a half inches in the case of Peking variety give maximum germination results.

Rainfall.

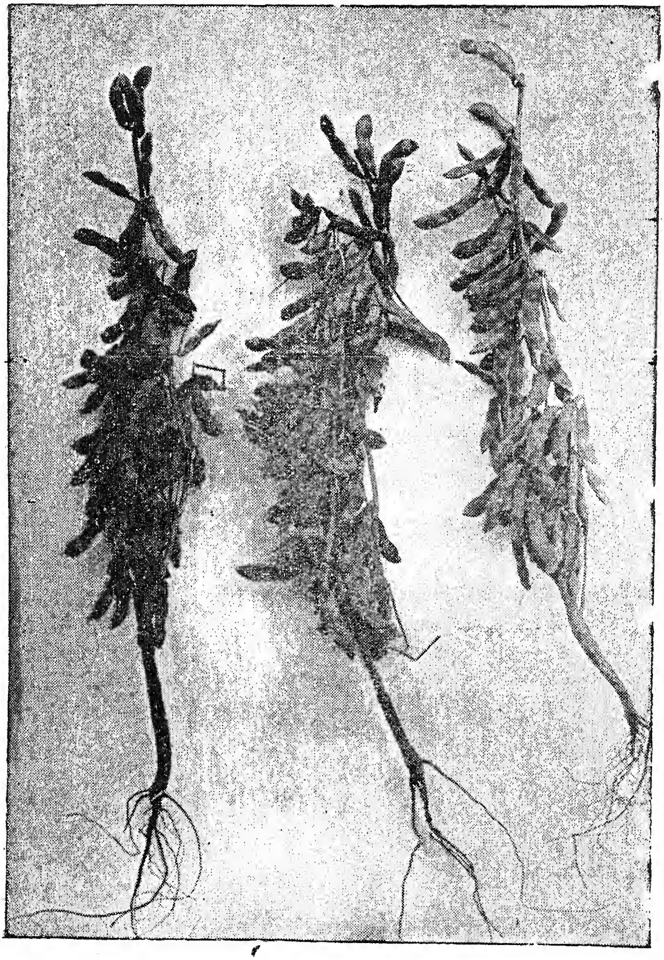
In regions where rainfall is excessive and, torrential, soya bean should be planted after monsoon, but where there is a moderate rain fall from 30 to 50 inches, it should be planted in the monsoon. However two crops of soya bean can be harvested in one year, one in monsoon and the other in winter. Soya bean can be sown in the Kyari land like wheat and gram after the paddy crop is removed. It should not be planted in a field where water accumulates. The flowers of soya bean are very tender and they fall off in excessive amount of rain.

Manure to be used.

In China and Manchuria the only fertiliser used is stable manure. In Japan wood ash and super phosphates of lime are used. Nitrogenous fertilisers are found to increase the yield and the percentage of protein much more than what is obtained with the help of mineral fertilisers. Most satisfactory results are obtained in India with the application of well rotten cow-dung manure. Farm yard manure about 10 to 15 cart loads is required per acre to ensure good results.

Cultivation.

Soya bean responds to good cultivation like any other crop. First, ploughing must be made early in summer and repeated harrowing at intervals should be followed, till the planting time. After the first shower light harrowing should be given to form a fine mulch on the soil to stop loss due to evaporation. The sowing should be started after the fall of the first few showers. The crop germinates within seven to nine days. The first interculturing by means of a hoe should be given three weeks after planting. The cultivation should be continued till the crop



The mature soya bean pods of mammoth yellow variety
grown in the Baroda territory.

flowers, at an interval of a week. This inter-cultivation smothers weed and to some extent covers the exposed roots. The crop blossoms after 45 days. No more intercultivation should be given after the flowering stage. The crop matures within 70 to 80 days and harvesting should be started when the beans show the brownish colour and when all the leaves fall off. Harvesting consists of cutting the plants which are finally dried in the sun. The beans when thoroughly dried can easily be thrashed with frail.

Yield.

With regard to the yield of soya bean there is a considerable variation. In Manchuria the yield varies from 1100 to 1600 lbs. per acre. In India with special reference to Gujarat the yield amounted to 700 to 900 lbs. per acre, in 1933. Experience has shown that more yield is possible from the acclimatised seeds. Every farmer should therefore grow his own seeds to obtain best results.

Soya bean hay.

The cultivation of soya bean hay rather differs from the seed cultivation. Thick

sowing should be done in order to get more leafy vegetation. The crops mature within 120 days and harvesting by means of cutting should be done before the pods and beans get yellow. If the cutting is delayed after the above stage the stems become fibrous, decline in feeding value and the leaves get yellow and fall off. After the rains are over cutting of the hay should begin. The plants should be allowed to lie on the ground and care should be taken to rake them before the leaves get brittle and dry. After raking the plants should be left in the open air for a day or two if weather permits. The hay can then be tied in small bundles. Five or six days of good curing is quite enough to make good soya bean hay. The soya bean hay yield will be from 1 to 3 tons per acre.

Viability of soya bean.

Even when properly stored seeds lose their viability rapidly. It is therefore advisable not to plant seeds more than two years old without first testing their viability. Care should be taken in storing soya bean seeds so that they may not get heated and thereby lose their viability. However a small

percentage of seeds may under favourable conditions retain its viability longer than three years.

Storing of soya bean seeds.

Storage of soya bean seeds requires special care. Massing of a large quantity of soya beans in deep vessels or poorly ventilated receptacles should be avoided as heating is likely to ruin the power of germination. If the grain is not thoroughly dry it should be kept on open floor for some time. Soya beans are seldom attacked by weevils like cow–peas or other grains.

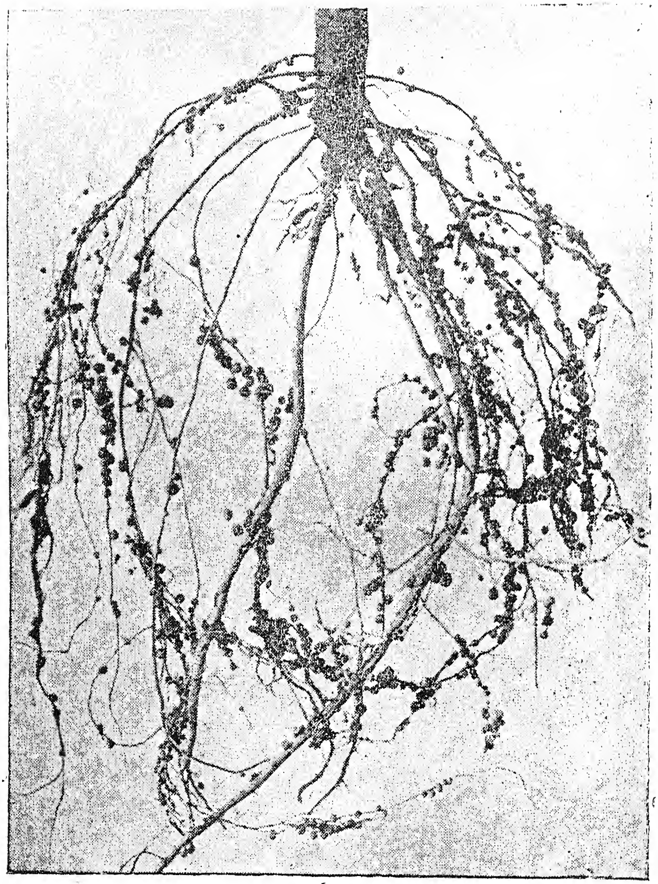
Inoculation.

When the soil does not respond to natural growth due to some deficiency, inoculation is essential. In European countries and in America, first trial with soya bean failed on account of the absence of nitrogenous bacteria in the soil. However, soya beans have given good results in rich soil where the bacteria was not present. In the cotton belt of Gujarat soya bean is seen growing very successfully. In common with leguminous plants soya bean utilises nitrogen of

the air through the action of bacteria which lives on the roots of the plants. The presence of these organisms is found by the development of nodules on the roots.

Climmer and Cruger (1014) made investigations of the bacteria from eighteen different legumes belonging to nine separate groups. But soya bean fell in a group by itself. On a soil poor in nitrogen soya bean will not succeed unless the bacteria is present.

A pale greenish colour of the plant is very often an indication of the lack of nodulation at the root. In 1886 Prof. Hellriegel discovered that this assimilation of nitrogen could be fostered by introducing in the soil certain microbes productive of the nitrogen or nitrogen gathering microbes which penitrate into the root of the plant forming nodules which constitute nitrogen serving centres that help to build up the value of the plant as a food producing legume. By increasing these microbes the plant is accorded an increased capacity for gathering nitrogen from the soil.



The nodules of the root of soya bean plant take nitrogen from the air and enrich the soil.

Artificial inoculation.

Nitrogenous bacteria is present throughout the regions where soya beans are grown extensively. When we want to plant soya bean in a soil where it is not previously grown it is quite essential to inoculate it. Most of the unsatisfactory results in the first trials of soya beans are due to the lack of proper bacteria in the soil. Inoculation, therefore, should be done either with pure culture which may be purchased at a laboratory or by using the inoculated soil from a field where the plant has previously developed nodules. It is believed that soil method is cheaper than the artificial inoculation method. Mix thoroughly with a bushel of beans about one gallon of finely shifted inoculated soil in order to obtain satisfactory results.

Influence of inoculation on the yield and composition of seeds.

Prince in 1915 at New Hampshire Experimental Station, reported that the inoculated soya bean gave 7·19 tons in weight to an acre while uninoculated soil gave 4·67 tons to an acre. This shows a gain of 2·5 tons to an acre for inoculated seeds. Chemical analysis

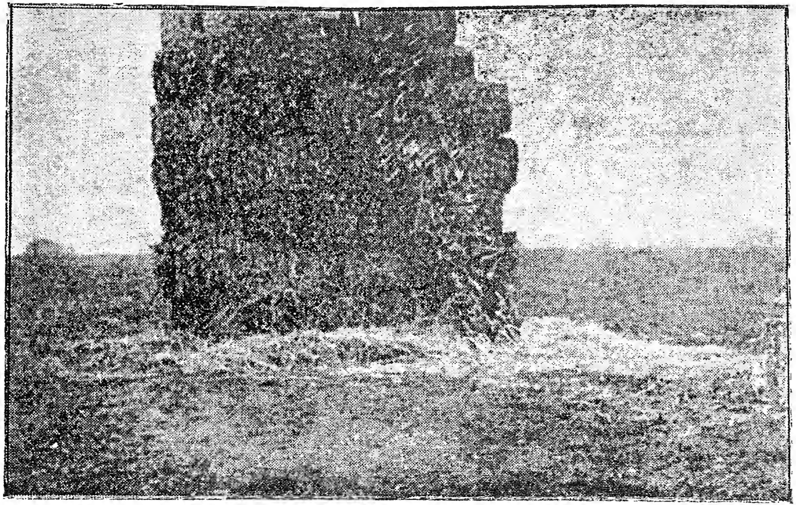
show that the protein content increases in direct proportion to the completeness of the inoculation. (Fellers 1918, New Jersey). Max Furstenburge states in his book on soya bean that inoculated soya bean crop yields 3 to 4 times the yield over those that are not inoculated. Also the beans of those plants inoculated are considerably larger than the beans of those plants which are not inoculated.

Soya bean as green manure.

Soils that have deteriorated in productivity through continuous cropping by the nitrogen using crops may be restored by the use of leguminous crops such as cloves, cow-peas, vetches and soya bean. Leguminous plants through the aid of root tubercle organisms are able to add to the available nitrogen of the soil and hence are extensively used in restoring those deficient in that element.

Soya bean for pasturage.

Soya bean crop may often be used as pasturage, most profitably perhaps, when fed to hogs or cattle to supplement the corn ration. It is also given to sheep with good results. This is especially desirable when harvesting



Soya bean Hay stack.

interferred with lack of labour, bad weather or other causes when the crop is grown for soil improvement. In this way the crop is not only useful for its manuring value but also for its feeding values.

Soya bean for soiling.

Soya bean has an important place among soiling crops. Having a content of protein, the crop may be fed to good advantages with less nitrogenous crop such as corn, sorghum and millet.

Soya bean for ensilage.

The use of soya bean for ensilage is not to be recommended as it gives out an unpleasant odour and produces bad effects on the quality of milk, butter and cheese.

Soya bean hay.

The principal value of soya bean hay lies in its high content of digestible protein. As indicated by comparative feeding tests, it is equal to clover, Alfalfa, lucern or cow-peas for milk and butter production. Soya bean hay makes an excellent ration in winter for cattle, sheep and horses and has been used to good advantage for hogs. The following table

shows the amount of digestible nutrients of soya bean hay which compares very favourably with the hay of other important crops.

Digestible nutrients in 100 lbs. of Hay substance.

(HENRY AND MORRISON, FEEDS AND FEEDINGS.)

Materials.	Total.	Protein.	Carbohydrates.	Fat.
Soya Bean.	53·6	11·7	39·2	1·2
Cowpeas.	49·0	13·1	33·7	1·0
Alfalfa.	51·6	10·6	39·3	0·9
Red cover.	50·9	7·6	39·3	1·8
Timothy.	48·5	3·0	42·8	1·2

Soya Bean Straw.

The straw obtained from thrashing the soya bean for seed is a valuable feed for all kinds of live stock. The straw is baled at the time of thrashing and is of considerable value as a fertiliser.

Fertilizing constituents of soya bean straw compared with the straw of other grains.

Soya Bean.

(Henry and Morrison, Feeds and Feedings.)

Straw.	Fertilizing constituents in 100 lbs.		
	Nitrogen.	Phosphoric.	Potash.
Soya Bean.	9·0	1·2	8·9
Wheat.	5·0	1·3	7·4
Oats.	5·8	2·1	15·0
Barley.	5·6	1·8	12·0
Rye.	4·8	2·8	7·6

One ton of soya bean straw contains nearly 10·1 lbs. of Nitrogen, 2·1 lbs. of Phosphoric, and 17·6 lbs. of Potash.

CHAPTER VIII.

Diseases of soya bean pests and measures of prevention.

In Baroda territory where soya bean was first grown in the year 1933–34 as an experimental crop, it has been found that "Katras" or hairy caterpillars, (Amascata Moorci) as they are called by the farmers of Gujarat, attack the plant when young. But if the plant is more than two months old, very little damage is done to it. "Katras" appear in the month of July and August. They die automatically within a period of about three weeks. "Katras" appeared in the Goradu soil but in the Besar and black soil they were very few. It is, therefore, better to sow soya bean after the "Katras" have died, that is, in the latter part of August or in the beginning of September.

Bacterial diseases in America.

Heald noted a bacterial blight of soya bean at Nebraska Experimental station

in 1904. Johnson and Coerper in 1917 reported that they had bacterial blight at Wiscousin Experimental Station. Wolf (1920) reported from North Carolina as having bacterial blight of soya bean there. At the Connecticut Experiment station, Clinton noted in 1915 a bacterial disease similar to that found by Heald in 1904. The soya bean leaves haid dark reddish brown spots about 1 to 2 mm. n diameter with somewhat irregular outlines. Sometimes the yellowing of the tissues outside the spots is visible in later stages, the diseased tissues get dry and drop out giving the leaves a ragged appearance. It is considered as a seed-borne disease. The infection is believed to spread from the cotyledon to the true leaves and from them to other leaves. The cause of the disease is said to be Becterium Sojae. The infected seeds are believed to be the chief means by which the disease is carried. The infected leaves also harbour the parasite.

Mosaic diseases.

In 1915, at Mount Carmel, Connecticut, Clinton found a mosaic disease of soya bean which he described under the name of

"Chlorosis or Crinkling". The mosaic affected plants get stunted and the peliols and the internodes were shortened to some extent. The leaves were also stunted. The pods on mosaic plants were stunted and flattened. The yield of the seed gets considerably reduced as the pods contain no solid seeds.

Fungous diseases:—

Many fungous diseases are known to attack soya bean plants.

Fusarium diseases.

This disease is characterised by Chlorosis as shedding of the leaves followed by the death of the plant. The fusarium disease of soya bean is carried by the same fungous that engenders wilt of the cow-pea.

Phoma disease.

The stems and pods of soya bean get affected in this disease.

Septoria disease.

This disease is characterised by enlarging spots appearing on both surfaces of young leaves which become discoloured and fall

off. This disease works towards the top of the plant very often ruining the crop.

Rot.

This disease is caused by a fungus, selerotium rolfsii which forms pinkish round bodies on the roots as large as peas. The root is affected and the whole plant succumbs. In Baroda, experiments made at the Agricultural Experimental Station, show that the commonly known cotton root-rot of Gujrat (Microspherious Phaseol) affects this crop (Dr. Likhite).

Nematode disease.

This disease causes injury to the roots of the soya bean and reduces the production considerably. This disease also occurs in Gujarat.

Insects.

They are enemies of the soya bean.

Leaf-hoppers.

They are present in great numbers in the fields. The lower leaves are yellowish and when the plants are distributed they fly out in numbers. They are known as Empo-as-ca Mali.

Thripes.

This is commonly found in the flowers of the soya bean plant in Japan. According to the investigations of different Japanese Agriculturists the pollen grains are damaged by the insects.

Legum-pod-moth.

These insects have been found to attack the soya bean pods.

Green clover worm.

The injury is caused by the worms eating the leaves and occasionally the blossoms, stripping entire field in a short time.

Mexican Bean beetle.

They also cause a great injury to the crop by diminishing the yield.

Bourtells Hortensis.

These insects attack the under surface of the cotiledons of soya beans near the edge where they make crescent shaped holes. They also make small holes in the upper surface of the seed leaves.

Caterpillars.

These insects sometimes eat the foliage but they do not do much damage.

The black blister beetle.

They at times do much damage to the soya bean fields.

Spanish fly.

They sometimes destroy the foliage but they are not considered as serious pest.

Grass hoppers.

They sometimes attack soya bean and do considerable damage.

Rabbits.

They are very fond of soya beans. They do great damage when the plant is tender and young.

Fowls.

They are also very fond of soya bean. When the seed is sprouted they eat away the sprouts and thus destroy the crop. They should not be kept in the vicinity of soya bean field. This year the author has sown soya bean in his garden. His fowls ate them all away when they were in the sprouting stage. Fowls have a great liking for sprouted soya beans.

CHAPTER IX

Cultivation of Soya bean in India.

Before beginning this Chapter, I would like to give an account of the experiments, carried on in Baroda State, in 1934 and 1935.

Following are some of the accounts of the experiments reported in the exact words of the farmers :—

From

Hargovan Bavabhai Patel,
Achisara, Taluka Sinor,
District Baroda.

To

Food Survey Officer,
Baroda State, Baroda.

Sir,

I have the honour to send herewith a report of the cultivation and the results of soya beans as follows :—

Place from where the seed was brought.

In the year 1934 in the month of June, 15 lbs. of good genuine seed was indented

The Indian method of interculturing with bullocks.

from F. S. Kale, the Officer in charge, Food Survey Department of Baroda State.

Preparatory tillage.

In summer, 5 cartloads of well rotten farm yard manure was carted in a piece of land of 10 vasas and then the manure was well spread and distributed evenly both lengthwise and crosswise.

Sowing.

At the start of the rain, the land was ploughed up bothwise and harrowed once and the seed was sown by means of seed drill 1 inch deep on the 12th July, and was covered by a country leveller.

Germination.

The seed began to germinate after 6 or 7 days after sowing i.e. on the 19th of July. Ten days after germination i.e. on 29th July, the plants had grown upto 3 to 4 inches in height.

Interculturing.

Interculturing by means of hoes was done at that time.

Gap filling.

Gap filling was done on 2nd August 1934 and interculturing by hoes was done second

time on the 12th August. Thus within one month the plants had attained a height of 9 inches to one foot and some plants had begun to flower. Third interculturing by hoes was done third time on 22nd August. At that time pod formation had begun on some of the plants and the pods were ready for making vegetable.

Pod formation.

Pod formation on the whole crop continued from 1st September and was complete on 1st October. Number of seeds in the pods varied from two to three.

Ripening of the pods.

On the 26th September, the leaves of the plants had begun to wither and drop down and the pods also were getting bold and ripe. At that time the height of the plants on an average was from $2\frac{1}{2}$ to 3 feet and the number of pods varied from 70 to 80 on each plant. On the 1st October almost all the leaves had begun to drop and the pods had begun to divide and dehisce after getting ripe and yellow and the ripening of the pods nearly finished on the 8th October.

Harvesting.

Harvesting was done on 10th October and the plants were left for drying for five days in the field.

Thrashing.

Thrashing was done by beating of sticks.

Yield.

The yield was 167 lbs. of seed.

Cost of cultivation.

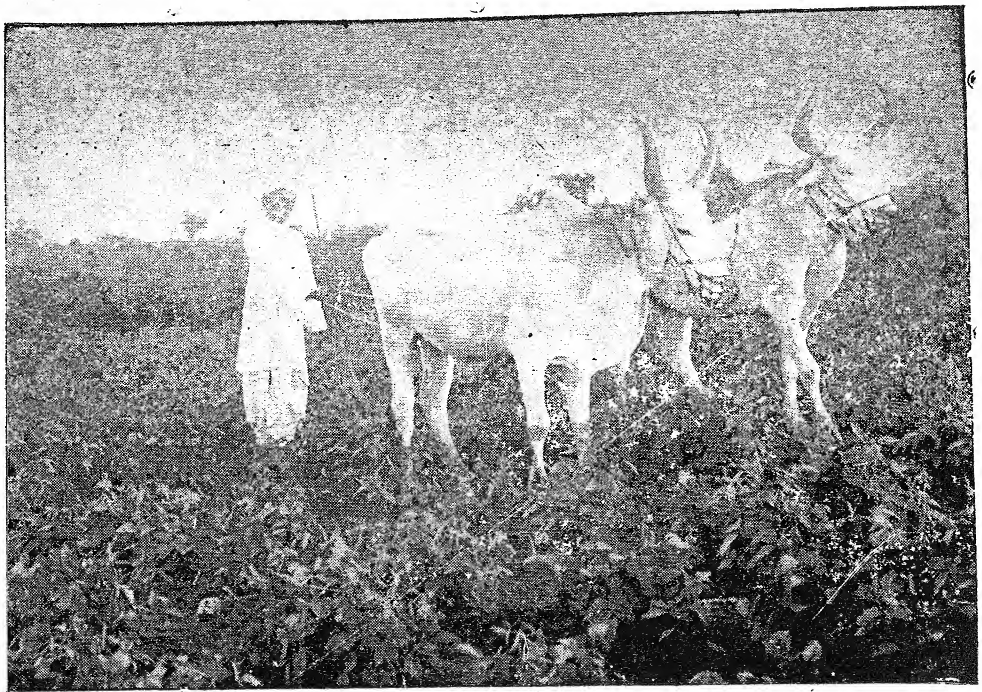
	Rs.	as.	ps.
Cost of seeds 15 lbs. ...	1	14	0
Manure 5 cart loads ...	2	8	0
Cost of land rent	2	0	0
Ploughing	1	0	0
Hoeing	0	8	0
Sowing, drilling, covering and levelling	0	8	0
Weeding	0	8	0
Harvesting	0	8	0
Thrashing and winnowing...	0	8	0
Watching the crop	0	8	0
Total ...	10	6	0
Income ...	20	14	0
Net profit ...	10	8	0
Profit per Acre is Rs.	42	0	0

The yield would have come more, if there had been cent per cent germination instead of 60 per cent which I got.

Experiment of soya bean.

1935.

This year the seed obtained was acclimatised seed from the last year's crop. This seed sown gives more successful result. The germination is upto 95 per cent compared to 60 per cent of the last year. Number of pods is also more i.e. from 110 to 130 on each plant giving the yield double of that of the last year. I believe there is no crop which is so early ripening within a month and a half, compared with soya bean crop. It becomes quite ready for the vegetable diet within a month and a half. This is why it is important as a vegetable for both the poor and the rich. Soya bean crop enriches the soil also. I have sown cotton in the same land where soya bean was taken last year and it is found that cotton taken in the land is found to be superior to the cotton crop which is taken after leaving the



Bavabhai B. Patel 65 years old farmer interested in the cultivation of Soya bean.

land fallow. In Gujarat in some places it is a custom that land is kept fallow for one year and next year cotton is taken but instead of leaving the land fallow, if soya bean is taken as a rotation crop there is no necessity of leaving the land fallow as double crops can be grown successfully with advantage to farmers and the soil is also renovated as soya beans is a leguminous crop.

This year's yield was double of that of the last year, 7 mds. 10 srs. or 290 seers for ¼th of an acre.

(Sd.) Hargovind Bavabhai Patel.

Food Surveyor's remarks.

Considering the above figures soya bean crop approximates to 1,160 lbs. per acre. The quality, the colour and the weight of the seed produced by the farmer were as good as the original one and the viability of the seed when tested gave 97·5 per cent result. This farmer has been allotted the first prize from the Baroda district.

From

Ranchhod Raghav Baria,

Kerianagas, Amreli District.

Cultivation of soya bean in S. No. 199–212.

Sir,

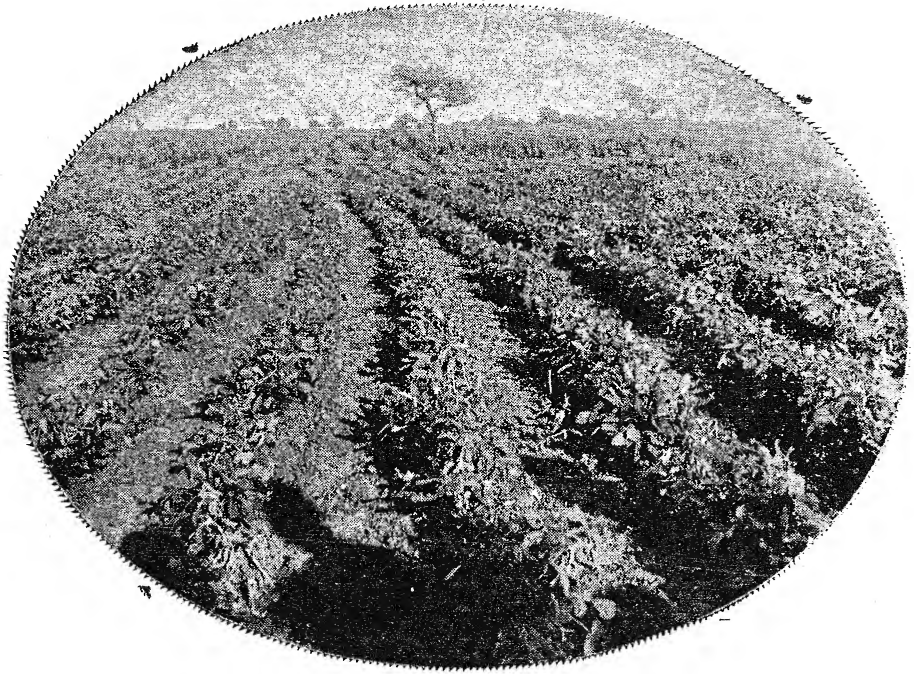
I have already forwarded a report on the cultivation of soya bean with a certificate of a Talati, the village accountant.

2. I have sent a sample of soya bean crop of Survey No. 199 by post parcel. I will wait for two days for your acknowledgment of the seed and in case you have not received the same I will arrange to send another sample on hearing from you.

3. I have taken the signature of the Talati on the statement of cultivation of soya bean sent to you.

My experience on the cultivation of soya beans.

1. After sowing soya bean in the soil it was attacked by a beetle and so 2/6th of the seed was spoiled, and when the crop had reached upto 15 days, only half the crop had



Soya bean grown by Patel Hargovan Bavabhai of Achisara Baroda District who has been awarded the first prize for his good cultivation.

survived. These beetles generally attack the groundnut and as this year soya bean was the only crop, it was heavily attacked.

2. Plants had begun to flower after 25 days and the flowers were whitish and bluish and pods had begun to form after 1½ month.

3. When the pod formation had begun, crows and parrots began to attack and so half of the pods were spoiled or damaged by them. These birds generally attack when pod formation begins, but as Bajri was taken side by side, the damage was less and no watchman was kept.

4. This year, in the monsoon, in the beginning, there was good rain but afterwards it dropped and so no branching really speaking had taken place except in some few plants.

5. This year the seed was given to some 16 to 17 cultivators. Some had sown it along with cotton and some others had sown it with Bajri as a mixture crop. Their experience of soya bean with cotton seems to be encouraging and so some people are inclined

to take soya beans along with cotton. This crop also grows luxuriantly and the number of pods are profuse. Therefore the general feeling among the cultivators for taking soya bean with cotton is enhanced.

6. If there is no attack of pests, crows or parrots and the rain is in time and equally distributed, the yield may come upto 15 mds. per bigha. I recommend 40 lbs. as seed rate per bigha when it is taken as a main crop only. Some cultivators of the British territory also intend to take up its cultivation.

7. In Survey No. 212 small seed at the rate of 1 lb. per rupee was indented from Parker & Co., Bombay on 26–6–34. Plants of this type were short and stunted and branching was less but profuse. Manchurian soya beans both as green vegetable and also for hotch-potch were used. They are very tasteful and relishing. I have got its seed in stock as-much as required by me and so I have not disposed off any seed and hence I cannot give you its rates for selling in the Bazar.

8. In short, this is my substance of the culture of soya bean, or say a story or an experience of soya bean, and which I have to the honour to submit you.

I have the honour to be,
Sir,
Your most obedient servant,
(Sd.) Ranchhod Raghav Baria Patel.
(Head man of the Village).

Food surveyor's remarks.

This farmer has been given the first prize in Amreli district. The committee has found these seeds better in colour and weight and quality when compared with the original imported seed. We are very hopeful that this part of Gujarat will be very well suited for soya bean crop.

EXPERIMENTS OF 1934 AT THE BARODA AGRICULTURAL EXPERIMENTAL STATION.

Soya bean-Fodder type.

Cultivation of Soya bean in India.

1934.

BARODA AGRICULTURAL EXPERIMENTAL FARM.

Serial number.	Type of Soya bean.	Germinal percentage.	Date of sowing.
1	2	3	4
1	Poona greenish white.	90	3-7-34
2	Yellowish white.	90	3-7-34

Date of flowering.	Date of pod formation.	Date of harvesting.
5	6	7
28-9-34	20-10-34	4-12-34
29-9-34	15-10-34	4-12-34

Soya bean plant having more than 500 pods, fodder type variety grown at the Agricultural Experimental station, Baroda.

Character of seed and plant.

1. Seeds smaller and green, growth of the plant healthy, vigorous and more or less even, branches profuse, leaves long, lanceolet, flowers coloured, late maturing type.

2. Seed small and yellow, growth healthy and vigorous, branching less, leaves broad and round, flowers coloured, late maturing type.

Poona greenish white.

This seed was brought from Poona Agricultural College. This is a fodder type variety.

Description.

Seeds are small and green each weighing one and a half grain. The type of soil selected is Garat sandi loam. No manure was used.

Preparation of the soil.

In summer, 2 to 3 harvestings were given. The soil was made loose and friable by leveller. (Samar as it is called in Gujarat) The rains began in the last week of June. The seed was sown on the 3rd of July. The rate of seeding per acre was taken as 30 lbs. The distance between

the two rows was kept as 2 ft. The sowing was done in rows by a country seed drill. (Tarphen). The thick seeding was done in order to have luxuriant vegetation. The seed appeared on the ground on the 6th July. The whole germination was completed upto the 9th July. Percentage of germination was found to be from 85 to 90 p.c. By the middle of July " Katras " (hairy caterpillars) had appeared. This pest seems to have a great liking for this crop. A great damage was done to the young plants. It is advisable, therefore, to sow this crop after the appearance of Katras is over. The gap filling was done where the Katras had done damage and also where the germination was poor.

Cultivation.

This crop responds to good cultivation like any other corn. A light interculture was given when the plants were three inches in height i. e. 15 days after the sowing. The second interculturing was given 8 days after the first by means of country hoes. The third was inacted in a week's time. Weeding was done regularly when required. Within a month and a half, the growth was

Poona fodder type green variety grown at the Agricultural
Experimental Station, Baroda,

one foot and a half. Within a course of three months it had attained $2\frac{1}{2}$ to 3 feet in height. The growth was healthy, vigorous and more or less uniform since the beginning. This crop had a creeping, branching and spreading habit. The leaves were long, lanceolet. The branching was luxuriant and profuse. The blossom began to appear after 2 months and a half. The pods appeared after 20 days of blossoming. The pods were small and in axil and in bunches of 2 to 3. The pods had hairs on them.

Ripening.

The ripening of pods began after 4 months, and it continued for 15 days more. On the whole it takes nearly 5 months for the crop to be ready after sowing. When the beans turn yellow, the plants should be harvested, otherwise the pod shed on the ground.

Harvesting.

Harvesting is done by means of sickle. It is not uprooted but cut down. If the crop is to be used for the feeding of cattle it is to be harvested when quite green and before the

flowering stage, so that, second cutting can also be taken with advantage.

How to cure it for hay.

When the crop is nearly three months old, the harvesting should be done and the plants should be dried in the sun and then stacked.

The yield.

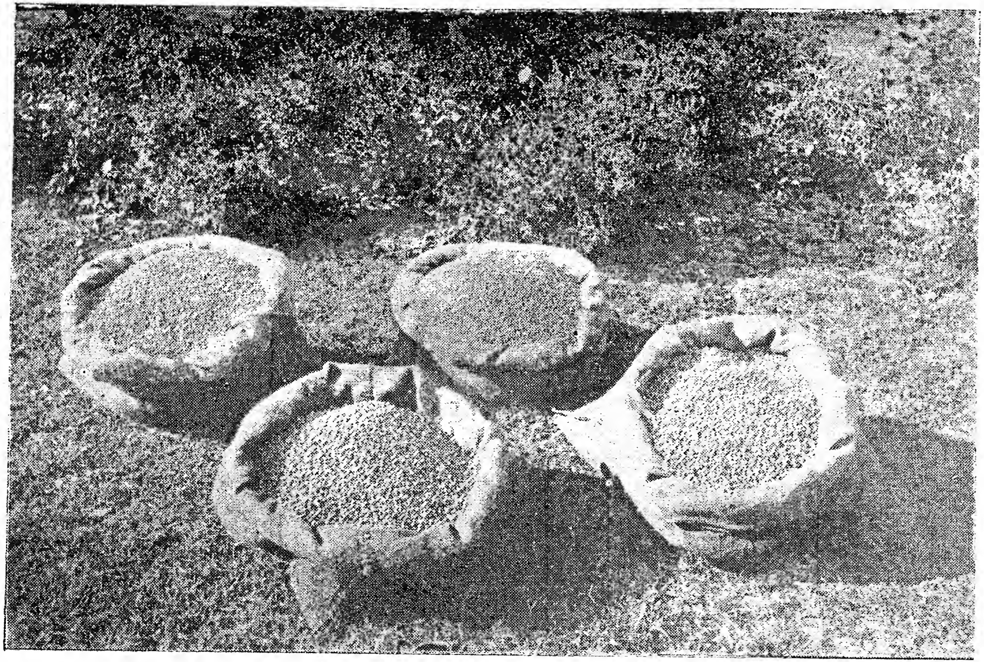
Yield of seed was 900 lbs. per acre. The yield of fodder was 50 maunds of dry weight. If the crop is to be used as green fodder, the weight of the green crop will come about 200 to 250 maunds or 3 to 4 tons.

We have given the green fodder to the bullocks on the farm and it seems that they relish it much and they put on more fat and seemed to be healthy and strong.

The plants when uprooted showed the growth of big nodules on the roots.

The yellowish white type :—

The other fodder type namely Poona yellowish white had less luxuriant vegetation and less branching than the greenish white. But the pods and the seeds were little bigger. The time required for the crop was the same.



Soya Bean seeds grown as Baroda State crop of 1935.

The yield was per acre 460 lbs. and the yield of the fodder was nearly 170 maunds.

The cultivation of the fodder type variety in Gujarat will solve fodder problem. The edible varieties give more yield in black and semi-black soil in Gujarat.

The composition of soya bean grown in Baroda State compared with those of Manchuria.

Legume.	Moisture. p. c.	Protein p. c.	Fat p.c.	Ash p.c.	N. F. Extract p.c.	Fibre p.c.
1	2	3	4	5	6	7
Baroda Soya Bean. Mammoth Yellow.	9·9	41·1	18·5	5·3	26·5	4·3
Manchurian Soya Bean. Mammoth Yellow.	9·7	38·5	17·5	4·5	26·5	4·5

Please note that the Protein and Fat is more in the Baroda grown soya–beans of edible variety than those grown in Manchuria.

DEPARTMENT OF AGRICULTURE, CENTRAL PROVINCES AND BERAR.

Soybean (Glycine hispida)

In this province the Agriculture Department started some preliminary work on this crop as early as 1911. A collection of different varieties from foreign countries was made and grown on the Nagpur farm. Particular attention was given to acclimatize it and to obtain suitable high-yielding early strains, possessing at the same time satisfactory percentage of oil. The work continued for some years but the results obtained were not satisfactory as none of the varieties were acclimatized. Further work was, therefore, dropped and the growing of Soybeans did not make any headway.

In 1927, the Botanical Section started the investigation of problems relating to fodder supplies, and in this connection a large number of leguminous crops including

Soybeans were tested. Of the Soybean, two varieties, *viz.*, Java black and Wilson early, gave encouraging results as regards their green fodder value. Java black was found to be more prolific as a green fodder and gave a high yield per acre. The experiments on the yield trials of some of the chief leguminous fodders were continued for three years and the result of these trials and the comparative position which Soybeans attained are given below :—

	Per acre in lbs.
1. Alysicarpus rugosus (Shevra).	20,105 (It gives two cuttings.)
2. Glycine hispida (Soybean Java black.)	12,505
3. Stizolobium (Velvet bean.)	12,095
4. Glycine hispida (Soybean Wilson early.)	11,905
5. Dolichos lab-lab (Popat.)	10,229
6. Vigna catjung (Cowpea.)	8,960
7. Cymopsis psoralioides (Cluster bean.)	7,805

From the above, it will be seen that the Soybean gives fairly high yield of nutritive fodder

and that it can easily be grown like any other leguminous crop in the kharif season.

During recent years, simultaneously with the testing of Soybeans for use as green fodder, work in connection with seed production has also been carried on. A large number of fresh varieties from Kalimpong (Bengal), Kuala Lumpur (F. M. S.), Barberton (U. S. A.), Leningrad. etc., were obtained and tested. The object of these experiments has been to find out the varieties which could be suitably grown and which might produce good seed of economic value for use as human food. Of these, three white seeded and one black seeded varieties gave promising results as regards their adaptability, earliness and yield. These types are being grown this year on the College farm on a field scale for multiplication of seed and for finding out the yield per acre in comparison with other leguminous crops like *mung*, *urid*, etc.

Further, with a view to find out their nutritive value as compared to that of *mung* and *urid*, these varieties have also been

chemically analysed this year and the results are given below:—

Varieties.	Protein.	Oil.	Carbo-hydrate.	Food units.
No. 49 ...	40·38	14·42	28·56	165·2
No. 53 ...	38·33	15·21	29·76	163·6
No. 57 ...	38·33	15·19	29·57	163·4
No. 59 ...	40·61	12·84	29·49	163·1
Mung ...	21·81	1·46	57·96	116·1
Urid ...	24·49	0·73	58·17	121·2

It will be seen that these selected strains are about $1\frac{1}{2}$ times more nutritious than *mung* and *urid* and also contain a high percentage of oil.

All the above experimental facts show that while the Soybean plant provides a nutritive fodder to the cattle, the seed itself can be utilised as a very nutritive food for human consumption, richer in qualities than *mung*, *urid* and other pulses.

With a view to test its taste and other cooking qualities, the selected and acclimatized varieties were distributed for trial in small

quantities amongst garden servants and some officials in Craddock Town, Nagpur. Their report shows that the Soybean is quite palatable and does not suffer from bad taste on account of the high percentage of oil. When ground into flour it can be mixed with wheat flour to make *chapatis*, *puris*, *kachoris*, fritters (*bhajias*) and other Indian preparations. One drawback, however, which has been noticed, is that it does not very well mix with water in the preparation of "dal" like other pulses.

During the year, the seed of the selected strains of Soybean was also distributed to some cultivators and others for trial. More seed will be available for further distribution by the end of this kharif season when the crop which is being grown on a field scale on the College farm is ready.

The usefulness of Soybean as an article of food for both man and cattle is indisputable. The only great difficulty which might beset its introduction on a wide scale is that our cultivators, being by tradition conservative, might take a long time to add a new crop to

those already grown, unless they can be persuaded that the crop will bring them more profit per acre. The latter will depend not only on the yield but also on the market prices. As regards the consumers, the factors to determine their choice will be taste and price. If the crop can be purchased cheaper than *mung*, *urid*, or gram, propaganda in regard to its higher nutritive value ought to be successful in overcoming any prejudice regarding taste, etc. Therefore, the cultivation and use of the Soybean in this province at present will have to be pushed through the enterprising malguzars and other rich and educated persons who are prepared to spend both time and money during the initial stages of its introduction.

SOYA BEANS IN BERAR.

BY MR. M. R. DOKRAS, B. A., LL. B.,

CHANDUR, BERAR.

IMPROVES SOILS.

The soya-bean plant is easy to grow and to harvest. It has a high seed-yielding capacity and being a legume is valuable as

an improver of the soil for succeeding crops. It can be grown for seed, hay, and pasturage. The oil that can be pressed out of the seed commands a high price and is useful in many trades such as soap-making, varnishes, paints, enamels, oil-cloth and other water proof goods. The oil becomes edible after refinement and it is claimed that it serves as a good substitute for olive oil also. The residues after the extraction of the oil-the cake and the meal-are high grade stock feeds. The bean has an exceptionally high protein value and contains vitamins necessary to life, making it a profitable component of human food. The staple food of the people may be said roughly to consist of meat, bread, butter and milk. Soya-bean is rich in all the constituents that are found in all these four items. The almost entire absence of starch points to its use in foods for persons requiring a low starch diet. It is of great value to persons who must abstain from meat and thus is a great help to the vegetarian population of the country. Soya-bean flour can be used in making biscuits, bread, cakes and numerous other foods for infants

and invalids. The dried bean provides a coffee substitute, fresh as well as condensed milk, sauces, soups and cheese. It can also be used as a green manure to restore the fertility of poor soils. Cultivation of the soya-bean provides food for the people and for the cattle.

CAN BE GROWN IN BERAR.

The soya-bean, with its many uses, is the most remarkable of all legumes; yet its real value is not fully recognized or even known to the cultivators in C. P. or Berar. The slow advance is probably accounted for by the fear that it is difficult to acclimatize, but within the last four years this feat has been accomplished and soya-bean crop has been successfully grown and harvested in Chandur in Berar. It is impossible to overestimate the far reaching consequences of this achievement to the agriculture in the province, if it is eventually proved that the crop can be grown all over on a profitable commercial basis. But for the sporadic attempts of a few enterprising officers, and farmers here and there, nothing has been done to

encourage the cultivation of this valuable legume in the province. But there ought to be no delay, now after the experience gained at Chandur, which has definitely established that the crop is capable of being grown and brought to maturity successfully in Berar. The public bodies and private farmers should encourage with energy and vigour the cultivation of the crop which has proved an undoubted success.

MY EXPERIENCE.

A small beginning in its cultivation was made in 1931. The rainfall was nearly 60 inches, i. e. double that of the average and the cotton crop was spoiled. But the soya-bean row improved and grew higher and higher till the rains ceased and put on a bumper crop, which when harvested gave an outturn of more than 2,000 lbs per acre. The acreage was increased in 1932. The crop was sown on high manured portions instead of on low water logged ones. The seed rate given was also as high as 20 lbs to the acre. The plot grew rather thick, and as there was very litte rain after August, the crop

suffered and the yield came to only 20 lbs. per acre. In the year 1933, the crop was sown in low-lying uumanured field which became water logged in August and no hoeing or weeding could be given till October when it was weeded and hoed. The yield was nearly 500 lbs per acre. In 1934 the portions sown were again water-logged and except two hoeings in the beginning nothing could be done by way of field operations. The crop had to be separated from the grass at the time of the harvesting but yielded nearly 350 lbs. per acre in unmanured portion and 800 lbs. per acre in manured portion. Some friends, to whom a little seed was given for experimental sowing, reported a crop of 209 lbs. per 6 lbs. sown even in water-logged soil. I got a crop of 7,000 lbs in this year.

A HELPFUL CROP.

From the experience during the last 4 years, it is proved that soya-bean yields best in years, of abnormally high rainfall. In fact it is the only crop which increases in yield according to rainfall; the higher the rainfall the better is the yield. Even in water-logged

and low lying portions the plants do not die out but live and put on a tolerably good crop after the cessation of the rains. That the crop does not suffer as much for want of weeding as cotton and other crops do. The abnormally high and late rainfall of the last 2 years prove the necessity of introducing a crop which instead of being badly affected by it would improve with the rains. That this crop gives a tolerably good yield even on portions where cotton and even Juar get rotten by too much moisture. That the crop when it is given 12 lbs. seed (worth Re. 1) per acre will be grown on any soil where Juar crop can reach maturity. That the rains in October which cause a lot of damage to the cotton crop and ruin the cultivators of the province will asure an increase in yield of the soya-bean acreage sown thus offsetting the loss in the cotton acreage.

Best Cattle Feed.

It is therefore advisable to cultivate soya-bean in portions of fields which are likely to be water-logged in rainy season with certainty of good crop therein and also in

small portions of good land which do not crack after the rains cease, for trial, with the hope of full success if the rains are abnormally high. It is necessary for local oil mill owners to get all up-to-date information about the extraction of the oil from the beans and its refining. It is also equally necessary for local scientists and public bodies which give scholarships for study abroad to arrange to encourage students to learn the technique of turning out all the above mentioned trade articles from the soyabean oil and arrange to start factories where these can be manufactured locally and thus lay the foundations of new local industries. Till this is arranged, the crop can find a ready market as beans for export with the aid of the recently organized marketing organization of the Central Government and the officers in charge of marketing of crops specially appointed for the province, a part of the same being utilized locally as the best cattle feed for bullocks and milch cows and buffaloes.

SOYA BEAN.

IMPERIAL DEPARTMENT OF AGRICULTURE IN INDIA.

[By Wynne Sayer, Esq., B. A., Dip. Agri. (Cantab.) Offg. Imperial Agriculturist, Pusa, Bihar.]

1. Figures regarding the cultivation of soybean in different provinces are not available here. They may be obtained from the Directors of Agricultural Department in different provinces.

2. Soybean is equally important as a fodder as well as a seed crop. In India it is considered as one of the best fodder crops. Its green yield is however slightly less than other *kharif* pulses viz. meth (Phaseolus aconitifolius), cowpeas (Vigna Catjang), and guar (Cyamopsis psoralioides), yet it occupies an important place in the grazing cycle for the milch cows as it remains green in the month of November when no other green fodder is available.

Owing to this gap in the supply of grazing for cattle in this month, the milk yield used to go down here considerably, but with the introduction of this crop the milk yield has

been kept up steadily and the difficulty has been solved.

As mixed silage, it increases the value of corn silage when chopped with maize.

As seed crop also it plays a very important part. In grain production it is far superior to other *kharif* pulses in yield and quality. It is very rich in mineral substances such as $P_2 O_5$, Fe, and Ca :and vitamins. It contains about 17% of easily digestible fat as valuable as yolk of an egg and has about 40% of protein (rich in ammino acid) hence it is one-third more valuable than other oil meals.

Owing to the absence of sugar content, it is considered to be a very suitable diet for diabetic patients. It serves as meat substitute and solves the problem of vegetarians. It has been strongly recommended by eminent doctors for rice eating people of Bengal and other parts of India.

Caloric value of soybean is far superior to other pulses and is only excelled by pea nuts.

In the Dairy Industry, it is considered to be a very important food for cattle. It works as a protein supplement and thus obviates the necessity of purchase of other seeds.

Soybean Nos. 1 and 2 of Pusa Farm selection have been proved to be equally good for seed and fodder purposes. They have been reported to be doing well in many parts of India.

3. In India it is generally used as green vegetables, *dal* and *sattoo*, but in America and Japan it is used in making breakfast feeds, biscuits, cakes, macaroni and other food products. It is also used in sauces, soups cheese in dried and fermented forms.

4. Experts in India and outside are unanimously of opinion that the extension of soybean cultivation is of great economic value as human food, cattle food and as seed of commercial interest in various industries.

Its oil is used in paints, varnishes lacquers and enamels, in the manufacture of linoleum, oil cloths, water proofs, printing ink etc.

Its root contains nodules which fix atmospheric free nitrogen in the soil and thus enriches the field in which it is grown.

The only drawback is that there is no ready market for its disposal in India as the people of this country are generally ignorant of its valuable properties—an ignorance which can only be removed with the advancement of scientific knowledge and propaganda among the people.

SOYBEAN (GLYCINE HISPIDA MAXIM)

BY M. WYNNE SAYER, B.A., DIP. AGRI. (CANTAB). I. A. S. OFFG. IMPERIAL AGRICULTURIST.

The soya bean is indigenous to Cochin-China, China, Japan, and Java. It is cultivated extensively throughout India, chiefly in the north Indian tract which extends from the Punjab to the Khasia and Manipur Hills and Burma; it is also grown on the slopes of the Himalayas up to an altitude of 6,000 feet [Duthie, 1903; Watt, 1890]. Its various Indian names are *Bhat*, *Bhatwan*, *Rum-kuthi* (Hind) *Bhut* (Punj.); *Gari-kalay* (Beng.)

Hooper [1911] followed by Woodhouse and Taylor [1913] made a thorough survey of this crop in India and the present article

is based mainly on the experience gained with this crop in the Agricultural Section at Pusa.

The plant belongs to the Natural Order *Leguminosae*, Sub-order *Papilionaceae*. It is a sub-erect, annual herb densely clothed with hairs. Leaves are 3-foliate and long petioled. Flowers are the axillary racemes; colour reddish-purple or violet. Pods 1–1¼ inches in length, densely pubescent and 2–3 seeded. Seeds are mostly elliptical and yellow, chocolate or black in colour.

ECONOMIC IMPORTANCE OF THE SOYBEAN.

This bean is much appreciated as human food on account of its protein and vitamin contents of high physiological value [Osborne & Mendel, 1917]. It occupies a position next to rice in China and Japan. Various preparations, such as *Tofu* (Soy-cheese), *Miso* (Soy-paste), *Shoyu* (Soy-sauce), etc., are made from the bean and widely used in those countries [Itano, 1919; Oshina, 1905]. In the United States and Germany, bean flour is used in baking [Adkins, 1920]. In India

it is used in various forms, such as *sattu*, *ata* and *dal*.

Soybean oil is largely used for edible purposes, in the preparation of soap and as a substitute for linseed oil in paints [Hooper, 1911].

A decoction of the root is said to posses astringent properties [Watt, 1890]. The bean is also recommended as a diet for diabetic patients.

CULTIVATION OF FODDER-TYPE SOYA-BEAN.

Soybean is a monsoon crop. It requires six to seven months from the date of sowing to the ripening of its seeds. It is generally sown alone for seed but sometimes it is mixed with maize which is considered to be more advantageous as after the harvesting of the maize in September, the soybean crop is left to stand for seed until December or January when it is harvested and usually the lack of moisture prevents the sowing of any other crop except perhaps sugarcane. If sugarcane is not grown, one crop is lost in *rabi*; while by growing soybean mixed with maize the loss of this crop is compensated.

A well-drained alluvial land is most preferable for this crop. It is sown after the break of the monsoon, i. e., from the middle of June to the end of July.

Before sowing, the land is prepared in the same fashion as for sowing other *kharif* pulses. The land is ploughed first, harrowed twice (with *spring tooth harrow*) and then *hangered.* After these operations, the plot is ready for sowing.

Soybean seed is generally sown with *Gujarat drill* in rows 2 ft. apart for seed, but when it is required to be sown mixed with maize the rows should be 2½ ft. apart; for fodder it should be either sown 1½ ft. apart or broadcasted, Sowing with drill is always done to make the intercultivation cheap and easy.

The seed rate is from 12 to 16 lbs. per acre when growing for seed but for fodder it is from 18 to 24 lbs.

This crop requires sufficient moisture in the top few inches of the soil for good germination. Shallow sowing is always preferable. The depth at which the seed is sown should not be more than an inch.

The luxuriant growth of the fodder type variety at the Baroda Experimental Agricultural Station.

After sowing, the seed should be either covered (by means of *Chain-harrow*) or the plot should be lightly *hangered.*

GREEN FODDER FOR CATTLE.

Soybean has been tested here for yield for a number of years against other important leguminous crops such as *meth*, cowpeas and *guar*. The results of 12 years' trials from 1917-18 to 1928-29 are given below:—

Average yield of grain and fodder produced per acre in lbs.

Fodder crops.	Grain.	Green stuff.
1. Soybean (*Glycine hispida* Maxim.)	1,166	7,453
2. Cowpeas (*Vigna Catjang* Endl.)	484	10,941
3. Guar (*Cyamopsis psoralioides* DC.)	942	9,128
4. Meth (*Phaseolous aconitifolius* Jacq.)	1,090	13,335

As regards grain production, soybean is 7 per cent. superior to *meth*, 24 per cent.

superior to guar and 14 per cent. superior to cowpeas but as regards fodder it stands last being 44 per cent. less than *meth*, 32 per cent. less than cowpeas and 18 per cent. less than *guar*.

In India, soybean is considered to be one of the best fodder crops. Here on the Pusa Farm, pulses are grown to be grazed off by cattle in *khanif* in the third year rotation. These pulses are cowpeas, *gaun*, *meth* and soybean which have fully established their value for feeding and grazing purposes after a number of years' trial. Soybean occupies an important place in the grazing cycle for the breeding herd as it stands green in the month of November when no other pulse is available for grazing. It fills up the gap between *meth* and berseem (*Trifolium Alexandrinum* L.)

On account of this gap in supply of grazing for cattle in the month of November the milk yield used to go down considerably. The grazing cycle of the green pulses for the breeding herd on the Pusa Farm is now as follows:—

Guar in August.
Cowpeas in September.
Meth in October.
Soybean in November.
Berseem from December to April.
Maize and *Meth* from May to July.

Soybean grain forms an excellent meal in the concentrated ration for milch cows.

GREEN MANURE.

The soybean plant is also used like sann-hemp and other legume crops for green manuring. Good results have been obtained by growing it in the sugarcane rotation (Arceneaux, 1932). The nitrogen percentage in the plant reaches the maximum when it is in full bloom (Piper and Morse, 1923).

STANDARD VARIETIES OF SOYBEAN ON THE PUSA FARM.

Regular trials of soybean varieties commenced on the Pusa Farm from 1917–18

when nine varieties of soybean were obtained from Sabour [Woodhouse and Taylor, 1913]. These varieties were tried in the Punjab Guntha plot for a number of years against the local variety, the results of which are given below:—

Average yield of seed per acre of nine varieties of soybean obtained from Sabour and a local variety tried from 1917–1923.

Serial No.	Soybean varieties.	Outturn in			Outturn in
		Mds.	s.	ch.	lbs.
1	Local (Pusa) ...	11	30	0	966·9
2	Nepali twining ...	10	10	13	845·1
3	Rice land	4	17	10	365·4
4	Barchet	5	8	5	428·5
5	Black early... ...	11	14	9	935·1
6	Black late	9	27	4	796·6
7	Yellow hilum brown.	13	28	5	1127·9
8	Chocolate	12	19	0	1026·5
9	Assam	7	26	10	630·8
10	Barmeli	6	29	4	553·9

In 1919–20, a number of plants were selected from different varieties of Soybean that did best, but ultimately only three plants from three separate varieties that gave the most desirable results were retained for further multiplication of seeds.

1. *Yellow Soybean.*–Late in maturity. Seeds yellow.

2. *Chocolate Soybean.*—Late in maturity. Seeds chocolate.

3. *Black Soybean.*—Ripens one month earlier than the above two types. Seeds black.

The above types are now taken as standard varieties of soybean on the Pusa Farm. They have proved much superior to all other varieties that have been received here from various places. The average yield of seed per acre of these varieties was 14·5 maunds (1,193 lbs.) in 1932–33. A sample of each variety was analysed by the Imperial Agricultural

Chemist, Pusa, and the results are given below:—

Chemical composition of the yellow chocolate and black soybean seeds.

—	Yellow soybean.	Chocolate soybean.	Black soybean.
Moisture	10·50	10·50	10·47
Oil (Ether extract) ...	16·43	1	14·36
Crude proteids ...	38·31	37·31	38
Soluble carbohydrates	24·18	24·39	23·42
Woody fibre ...	6·20	6·14	5·66
Soluble mineral matter.	4·35	4·25	4·67
Sand and Silica ...	0·03	0·03	0·04
Total N.	6·13	5·97	6·62
Albuminoid N. ...	5·89	5·77	6·23
Albuminoids ...	36·81	36·06	38·94
Albuminoid ratio ...	1·68	1·79	1·45
Food units	161·03	161·12	162·77
Oil (Ether extract) on dry matter calculated.	18·36	21·03	16·77

SOYA BEAN.

BY M. R. RY RAO BAHADUR D. ANANDA RAO GARU, B. SC., DIRECTOR OF AGRICULTURE MADRAS.

Soya Bean is under trial from 1932 in the Research stations, Aduturai, Maruteru, Hagari, Nandyal and Samalkota. The two varieties of Soya Bean from Barma viz. Behrum and Pengypi have done well and the trials are being continued. The yield per acre ranges from 1,000 to 2,000 lbs.

2. The uses to which Soya Bean can be put are under investigation. It is a new crop still under trial in this Presidency. The farmers are therefore not growing or using Soya Bean and propaganda has yet to be done on it.

BY K. S. KULKARNY, PROFESSOR OF AGRICULTURE, AGRICULTURE COLLEGE, POONA.

1. A variety of soils except too shallow and coarse would do for this crop; better ones are of course loams, either sandy or clayey.

2. The best season is the kharif, the rainfall range being about 25 to 30 inches.

3. The seed-rate in 16–20 lbs. per acre.

4. The same preparatory tillage as for *jowar* or *bajri* or like some of our kharif pulses like mung or udid is quite sufficient. Nothing special; interculturing twice and weeding once till the plants cover the land fully would be enough.

5. Germination is seen on the 4th or 5th day but is completed by 7 days.

6. The seeds should be drilled in lines 15″–18″ apart depending upon the type of soil.

7. A kharif crop would not need any irrigation with the above rainfall range. We have no experience of other seasons.

8. The yield of a Kharif crop varies 1100 lbs.–1600 lbs in our Poona medium black soil. We have no experience of other seasons.

9. It requires 4½–5 months depending upon the variety and season, the kharif crop coming off in about first half of November.

10. No pests or diseases have been observed except flea-beetles. But this has not been serious.

11. The chemical analysis of the two varieties is as under:—

	Yellow Broad-leaf erect.	Greenish Narrow-leaf creeping.
Moisture	68·70	70·80
Dry matter	31·30	29·20
Nitrogen	0·86	0·68
Fat	2·59	0·98

2. As regards medicinal value it has been found to be particularly useful in some cases in the form of small "Bhakris" for patients with defective digestion, with tendency to flatulency.

BY H. H. STEWART, ESQUIRE, I. A. S.,
DIRECTOR OF AGRICULTURE, PUNJAB.

Re:1:–The area under Soyabean crop in this province is practically nil. The crop has been tried on a few experimental farms of the Agricultural Department, where it yielded 12 to 16 maunds of seed per acre. Two varieties viz. Chocolate and Yellow have been tried and the seed-rate used per acre has been about 8 seers.

Re:2:–No information is available on this point.

Re:3:–As there has been no market for the crop, a few farmers, who ventured to grow it, were compelled to feed their produce to the cattle. It is not reported to have been used for any other purpose so far in the Punjab.

Re:4:–So far as is known at present, no farmer in the Punjab would be willing to grow Soyabean to be used as a staple human food or as a feed for cattle. There does not appear to be any local demand for any industrial use. Therefore the only probable means of disposing of the produce is to sell the commodity in the markets for export purposes. The facility to do so does not exist at present and this factor alone will certainly discourage the farmers taking up its cultivation even in localities where the condition may be favourable for its being grown successfully. It may be stated, however, that the crop can be grown successfully if the farmers

can find a good market for selling their produce at reasonable rate.

By the Superintendent of agriculture, Darjeeling, Kalimpong.

1. Soya Beans is cultivated chiefly as a secondary crop in rotation after maize or on the Alis or ridges of paddy fields. The approximate 5 years' average under this crop in the Darjeeling District is about 200 acres; but in the neighbouring independent States, such as Sikkim, Bhutan and Nepal the approximate average is 750 to 800 acres. The average yield for 5 years would be about 7,500 to 8,000 maunds and there are 6 or 7 varieties of Soya Beans grown in and around this district.

2. This crop is not grown for green-fodder purpose; but preferably for seed crop and human consumption; also as a green-manuring crop in Tea Estates.

3. It is chiefly used by the local farmers and hill tribes.

CHAPTER X.

The constituents of soya bean.

Composition of soya bean.

It is a most marvellous feat of nature that soya bean is able to extract from the soil and air an extraordinary quantity of protein, fat and mineral salts within a short period of 80 to 90 days.

Extensive investigations were made by the Japanese, American, and European chemists with regard to the composition of the soya bean seed. The chemical composition of soya bean seed differs widely from other cereals and legumes. The difference lies principally in the amount of nitrogenous substances, oil contents and the entire absence of starch. It contains far more protein than any other ordinary pea, bean or lentil. It differs largely from other legumes not only in the quantity, but also in the quality of its nutrient.

The composition of soya bean seed compared with those of other legumes by Henry and Morrison.

Legume.	Moisture p.c.	Protein p.c.	Fat p.c.
Soya bean.	9·9	36·5	17·5
Field pea.	9·2	22·9	1·1
Cow pea.	11·6	23·6	1·5
Valvet bean.	11·7	20·8	6·4
Garden pea.	11·8	25·6	1·6
House bean.	12·6	26·2	0·9
Navy bean.	13·4	22·7	1·5

Legume.	N. F. Extra p.c.	Fiber p.c.	ash p.c.
Soya bean.	26·5	4·3	5·3
Field pea.	57·8	5·6	3·4
Cow pea.	55·8	4·1	3·4
Velvet bean.	51·0	7·5	2·6
Garden pea.	53·6	4·4	3 0
House bean.	49·4	7·1	3·8
Navy bean.	53·0	5·8	3·6

It can be noticed from the above table that soya bean contains the highest amount of protein, fat and mineral salts, while other peas and beans are deficient in the amount of fat. The less a plant claims from a soil and the more nutritious food it gives, the higher is its estimate and value from an Agricultural and commercial point of view. Such a plant is soya bean.

Composition of the different parts of the soya bean by Lechartier.

Part of seed.	Proportion of seed.	Dry matter.	Nitrogenous substance.
Entire seed.	100	90·18	38·06
Cotyledons.	90	89·43	41·33
Embryo.	2	87·99	36·93
Seed coat.	8	87·47	7·00

Part of seed.	Carbo-hydrates.	Fat.	Ash.
Entire seed.	12·06	17·80	4·44
Cotyledons.	14·60	20·75	4·38
Embryo.	17·32	10·45	4·08
Seed coat.	21·02	0·60	3·83

The chemical analysis of over five hundred different varieties of soya bean made by the United States Department of Agriculture show a range from 30 to 45% protein, from 12 to 24 % fat and 4 to 5 % mineral salts.

In Manchuria, at the Agricultural experimental station of Kingchu-ling (South Manchurian Railway), thirty different varieties of soya bean from various parts of Manchuria were selected and analysed. The analysis showed the average composition of thirty different kinds of beans as follows :—

Protein	... 42·84%
Fatty contents	... 19·90%
Mineral salts	... 4·15%
Water	... 8·60%

It was also found by experiments that the yellow variety of soya bean are the richest in protein and fat contents. Green variety of bean comes next and the black comes last in point of protein and fat contents. Farmers who desire to take up cultivation of soya bean in India are, therefore, recommended to grow the yellow beans in preference to others.

Street and Bailey conducted rather extensive investigations on the Nitrogen–free extract of soya bean.

The percentage composition of the Nitrogen free extract of soya bean by Street and Bailey.

Galactan ...	4·86
Organic acids ...	1·44
Pentosan ...	4·94
Innert sugar ...	0·07
Sucrose ...	3·31
Raffinose ...	1·13
Starch ...	0·50
Cellulose ...	3·29
Undermined hemicelluloses ...	0·04
Waxes, Colour principles tanins.	8·60
Dextrin ...	3·14
Total ...	31·32
Galactan from Raffinose ...	0·24
Per cent Nitrogen–free extract...	31·08

The analysis of the ash of soya bean.

Campbell made investigations of the ash of soya bean. Average p.c. in soya bean is 4:5.

Composition of ash–by Campbell.

Potassium (K_2O)	...	44·82
Sodium (Na_2O)	...	7·21
Calcium (C_aO)	...	6·12
Magnasium ($Mg O$)	...	6·12
Phosphoric acid (P_2O_5)	...	28·66
Carbonic acid (CO_2)	...	1·62
Sulphuric acid (SO_3)	...	1·38
Chlorino (C_1)	...	0·65
Undetermined	...	3·42
		100·00

NOTE :—The ash of soya bean is rich in Potassium and phosphoric acid.

Pellet in 1880 conducted extensive investigations relating to the mineral contents of the ash of soya bean.

Analysis of the ash of soya bean by Pellet.

	Sample 1.	Sample 2.	Sample 3.
Potassium (K_2O).	45·02%	45·27%	45·02%
Phosphoric acid (P_2O_5).	29·13"	31·92"	31·68"
Lime (CaC).	8·92"	6·50"	4·48"
Magnesium (Mg0).	8·19"	6·48"	8·47"
Carbonic acid (CO_2).	1·70"	1·20"	1·00"
Sulphuric acid (SO3).	1·37"	4·80"	2·74"
Chlorine (C1).	0·75"	0·75"	0·75"
Insoluble.	1·10"	1·10"	1·20'
Trace Na0, Fe0.	1·59"	2·15"	4·83"
Total.	100·17	100·17	100·17
Deducting O_2 for C1,	0·17	0·17	0·11
Total.	100·00	100·00	100·00

NOTE :—The ash of soya bean is rich in soluble phosphates & potassium.

Bowers made extensive investigations regarding the mineral contents of soya bean.

Analysis of the mineral contents of soya bean compared with those of other beans by Bowers :—

Legumes.	Potass. p. c.	Sodi. p. c.	Cals. p. c.	Magne. p. c.
Soya beans.	2·095	0·380	0·230	0·244
Navy beans.	1·390	0·086	0·235	0·206
Cow peas.	1·636	0·189	0·117	0·143
Peanuts.	0·061	0·563	0·068	0·180

Legumes.	Sulph. p. c.	Chlor. p. c.	Phospho. p. c.
Soya beans.	0·444	0·025	0·649
Navy beans.	0·224	0·047	0·429
Cow peas.	0·2[illegible]0	0·047	0·532
Peanuts.	0·254	0·024	0·399

NOTE :—The soya bean is very rich in soluble phosphates, potassium and sulphur.

Proteins in soya bean.

The soya bean contains the highest amount of protein and its proteins differ from other cereals and legumes, not only with respect to anatomical structure but also in the formation of chemical composition. The proteins of soya bean also differ in the character and variety of Amino-acids which they yield on digestion.

The investigations of T. B. Osborne and S. M. Mendle, made during the great war in America, pointed out the unique qualities of soya bean protein among the vegetable proteins. They stated that proteins of soya bean are "Good" proteins from biochemical point of view. In their experiments they observed that soya bean proteins reacted like animal proteins and could actually replace them.

Osborne and Clapp made extensive investigations on the Amino-acids of the proteins of soya bean and they were led to the conclusions that the amino-acids of the proteins of soya bean are much similar to those of cow's milk.

Comparison of the amino-acids of the proteins of soya bean and Cow's milk by Osborne and Clapp :—

Amino-acids.	Soya bean.	Cow's milk.
Glysine.	0·97	0·00
	not isolated.	
Alanine.	0·63	...
Valine.	8·45	7·20
Sencine.	...	9·40
Protein.	3·75	6·70
Phenylalamine.	3·86	3·20
Aspartic acid.	3·89	1·40
Glutanic acid	19·45	15·55
Serine.	not isolated.	0·50
Tryptosine.	1·86	4·50
Arginine.	5·12	4·84
Histidine.	1·39	2·59
Lysine.	2·71	5·95
Ammonia.	2·56	1·61
Tryptophane.	present.	1·50

Osborne and Clapp further stated that the proportion of amino-acids in the glysine is not much different from that found in animal flesh and approaches them more

closely than does the proportion of the amino-acids in the proteins of wheat, other cereals and pulses.

It was concluded by these investigations after a series of experiments that the proteins of soya bean fulfilled all physiological requirements and appeared to be just as valuable as the casein in the milk. These investigations stated that these discoveries were somewhat surprising in view of the fact that the proteins of other legumes namely peas and beans had been found wanting.

Protein of soya bean is alkalyzing in its effects.

It was found at the laboratories of Dr. Henry C. Sherman, Professor of Food Chemistry at Columbia University that the proteins of the meat and fish as well as eggs and grains, are acid-producing while those of soya bean are alkalyzing in their effects which make them a desirable substitute as human food. The studies made by Osborne and his corroborators at St. Barbaras' Hospital show that after a meal of soya bean the alkalinity of the blood of their patients increased. (A most valuable consideration where alkalinity

of blood requires to be increased). Recent experiments have also shown that human organism retains more nitrogen from soya bean proteins than from meat proteins.

Further it may be observed that the proteins of soya bean have the great advantage of being free from nucleoproteins and therefore soya bean does not lead to the formation of uric acid and in consequence does not encourage gout. Gout is unknown in China, which is the home of soya bean.

Vitamins in the soya bean.

The biochemical researches and the feeding tests of Daniels and Nichols (1917) and Osborne and Mendle (1917) regarding vitamin contents of the soya bean showed that rats grew normally on a diet containing 50% of soya bean and produced young ones which in their turn produced young ones again. No disease of any kind was noticed during these experiments. The result clearly indicated that soya bean contained sufficient amount of fat-soluble vitamins A and D and water-soluble vitamin B which are quite essential for the promotion of growth and reproduction.

Another group of rats was fed on a diet lacking in soya bean. These rats suffered from eye diseases and they showed nutritive decline on account of the deficiency of the fat soluble and water soluble vitamins.

When soya bean seeds are soaked in water and sprouted, they contain vitamin C which is found in fresh fruits and green vegetables.

Soya bean oil.

The oil content of soya bean is from 15 to 24%. The constituents of soya bean oil after mixing 48 samples of soya bean oil from different varieties are as follows:—

Specific gravity at 15°c ...	0·9212.
Saponification value	188·65.
Acid value	0·28.
Reichert–Meissl value... ...	5·30.
Hehner value	93·50.
Neutralization value	177·82.
Iodine value	127·78.
Iodine value of unsaturated fatty acids	131·93.
Unsaturated fatty acids ...	8·61.

Ether number ... ...188·37.
Glycerol ... ... 10·29.
Mean molecular weight ...315·5.

Matthes and Dahle (1911) reported that soya bean oil contains 15% of palmit acid.

Meissl and Bocker (1883) in their investigations found that the oil of soya bean contains no fatty acid and that it consists entirely of neutral triglycirides.

Lewkowitsch (1904) in his investigations on the oil of soya bean said that soya bean does not give reaction which is so characteristic of cotton seed oil.

The constants of soya bean oil by Holland compared with those of other investigators.

Investigators.	Specific gravity. 15%	Saponification value.	Iodine value.
Holland.	0·9206	191·95	130·77
Morgan.	0·9193	187·27	129·72
Morawaski & Stingi.	0·9270	192·90	122·20
De Negri & Fabrus.	0·9242	192·50	121·30
Shukoff.	0·9240	190·60	124·00

The maximum, the minimum and the average of the more important constants of soya beans from 48 varieties compared with those of other oils by Holland.

Oils.	Specific gravity.	Saponification value.	Iodine value.
Maximum.	0·9235	195·40	139·96
Minimum.	0·9108	174·08	114·01
Average.	0·9193	187·27	129·72
Linseed oil.	0·9316	192·00	80·00
Cotton seed oil.	0·9230	192·00	108·00
Corn.	0·9274	191·90	125·90

The oil of soya bean is of superior quality. Dr. Mendle and his collaborators, of Yale University fed groups of rats on a fat diet, cocoanut oil and other oils. The rats thus fed were lazy and inactive and spent day and night in sleeping. They had access to revolving cages into which they would go for a few minutes and then go to sleep again. The rats fed on soya bean oil rushed into the revolving

cages and ran sometimes for ten hours without interruption. This went on for several days with good condition and normal sleep by day. The soya bean oil imparted an amazing amount of energy while the other oils did not do so.

Starch in soya bean.

It is important to note that soya bean contains hardly any starch. Blondell (1888) and Prinsen (1896) in their investigations on the starch content of soya bean did not find any starch. Meissl and Bocker (1883) after an extended study of the soya bean reported a small amount of starch varying from 1 to 3% in certain varieties of soya beans.

Starch content of soya bean by Dr. Albert Mann.

Dr. Albert Mann conducted extensive investigations as regards the starch content of soya bean. He concluded his studies by stating that the dark and brown seeded variety have practically no starch, while yellow seeded varieties show little trace of starch.

Following are some of the varieties of soya beans containing no starch and some varieties containing a small amount.

SOYA BEAN.

Variety.	Colour.	Starch content.
Virginia.	Brown.	No starch.
Wilson.	Black.	,, ,,
Peking.	Black.	,, ,,
Mammoth	Yellow.	A very small amount.
Manchu.	,,	,, ,, ,,
Ito san.	,,	,, ,, ,,
Tokio.	,,	,, ,, ,,
Easy cook.	,,	,, ,, ,,
Haberlandt.	,,	,, ,, ,,

Carbohydrates in soya bean.

As stated above soya bean contains hardly any starch but it contains carbohydrates in small molecules.

Bailey and Street (1915) conducted rather an extensive investigation on the contents of soya bean. After their studies they concluded that soya bean contains a good quantity of carbohydrates amounting from 22 to 29% depending upon its variety and maturity.

The defects of the common food grains of India.

The chemical analysis, the biochemical researches and the feeding tests on animals

conducted by Major General Sir Mac Carrison at the Pastuer Institute of Coonoor, South India, regarding the common food grains of India such as wheat, rice, bajri, maize cholam, cambu and ragi which form the staple articles of diet of the different races of India, indicate that they are defective. If we examine wheat, bajri or millet and rice which are the staple articles of diet all over India we will find the following defects in them: —

(1) Wheat:—It is a staple article of diet in the North Central India and some parts of Gujarat and Deccan. It contains enough carbohydrates; but it is deficient in fat, and vitamins A, C and D. It is also deficient in certain mineral elements; particularly Calcium, Sodium and Chlorine.

(2) Bajri:—or ragi or millet. It is deficient in proteins, fat and vitamins A, C, D. It is poor in mineral salts; especially Calcium. It lacks the vegetable residue which helps the process of digestion and the action of the bowels.

(3) Rice:—It is the staple food of vegetarian Indians mostly in Bengal, Assam, Burma and some parts of Bombay Presidency, especially in Madras Presidency. It contains

sufficient carbohydrates, but less protein and its proteins are poor in quality. It is deficient in vitamins B and partly in A, C, D. Similar is the case with other staple food grains, viz. Barley, Maize, Cholem, Moog, Udad, Grams, Wal, Tur, etc. In soya bean all the above deficiencies found in the staple food of India are overcome.

Comparison of common food grains with that of soya bean. (From Bombay Baby Health Week Association Chart).

Food grain.	Protein p.c.	Fat p.c.	Carbohydrates p.c.	Salts p.c.	Calories p.c.
Soya bean.	40	20·3	24·6	4·8	2,100
Wheat.	12	1·7	73·7	1·5	1,750
Bajri (Bulrush Millet).	10	5	74·2	2	1,750
Jowar.	8·9	3·1	71	2·5	1,750
Rice (whole).	7·5	1·8	82	0·8	1,800
Grams.	19	4·3	54	2·8	1,530
Lentils.	25	1·5	60	6	1,600
Peas and beans.	24	1·5	60	3	1,700
Linseed.	24	40	26	2	2,270
Ground nut.	24	45	22	2	2,450
Meat.	24	2·5	...	1·5	576
Eggs.	14·8	10·5	...	1	720
Milk.	4	5	4	0·8	480
Potatoes.	3	12	14·2	1	195

Calcium in soya bean.

It has been known that calcium or lime is one of the food minerals most essential for the maintenance of bodily health. Lime is needed not only for bone-building and the maintenance of a healthy state of the bones, but for the nutrition of the brain and the nerves. Calcium is also an essential element of the blood.

Many of the articles of our food are greatly deficient in lime. This is a matter of serious consideration for the reason that the human body daily loses through the kidneys and the bowels seven to ten grains of lime which must be replaced to prevent serious injury to health. A few articles of our diet are rich in lime, but most of them are very deficient in this element. Fine flour bread, for example contains only one grain of lime to the pound, or one tenth of the daily requirement; while the fat of meat contains no lime at all, and the lean of meat only half a grain to the pound.

Cow's milk on the other hand contains three quarters of a grain to the ounce, or twelve grains in a pint.

Soya bean is also rich in lime. A recent study made at the Yenching University of Pekin, China, (Adolph) showed that the soya bean curd known in China as *toffu* is as efficient as milk as a source of Calcium.

Osborne and Campbell in their investigations stated that the chief proteins in soya bean are globulin and glysine. Its composition is as follows :—

Carbon	...	52·12
Hydrogen	...	6·93
Nitrogen	...	17·53
Sulpher	...	0·75
Oxygen	...	22·63

A Japanese investigator Oshima found that soya bean contains as much as 6·9% of albuminoid nitrogen. The same investigator points out that the protein of soya bean yields on digestion a complete aminoacid mixture.

Meissl and Bocker made extensive investigations with regard to the proteins of soya bean and stated that soya bean contains the following proteins :—

A Casein like substance.	27·6%
Albumin.	0·5%
A protied precipitated by cipric acid.	2·5%

Osborne and Mendle (1917) found that rats grow very normally on glysine. It was also investigated by them that cystine, lysine and tryptophane had to be added to any protein that does not contain them to make up its growth-promoting quality. The protein of soya bean has these aminoacids. It was also observed by Osborne and Mendle that when the protein of corn lacked the above amino-acids and when it was supplemented by the addition of the proteins of the soya bean, the growth of rats became very normal and satisfactory.

Daniels and Nichols (1917) have conducted rather extensive investigations with regard to the nutritive value of the proteins of the soya bean. In a series of experiments on rats it was found that the animals, fed on rations containing 15·6 and 18·7% of protein, obtained solely from soya bean, grew quite normally and in the latter case produced successive litters of young, which in their own turn bred successive litters.

Analysis of Soya bean plant.

Lechartier has made the most detailed study of the nutritive and mineral constituents

of the different parts of the plant. The nutritive constituents contained in each part of the soya bean plant are given below :—

	Green.			
	Stems %	Leaves %	Pods %	Entire plant %
Proportion.	25·45	40·18	34·37	100·00
Water.	18·62	29·38	25·98	73·98
Total Nitrogen.	0·05	0·19	0·26	0·50
Protein (crude).	0·34	1·15	1·63	3·12
Amides.	0·09	0·14	0·18	0·41
(Material)	0·27	1·03	1·38	2·68
Fat.	0·07	0·42	0·57	1·06
Carbohydrates.	2·19	2·39	2·34	6·92
N. Free Extracts.	1·33	3·49	1·38	5·20
Cellulose.	2·84	1·91	1·87	6·62

Lechartier, in his investigations of the mineral constituents of the plant, found that the leaves and stem both contain some phospheric acid. At the time of the maturity of the plant the phosphates pass from the leaves to the pods and then to the seeds which contain phosphates in large amount.

The proportion of the sulphuric acid diminishes in inverse ratio as the plant attains maturity. Calcium and magnesium are found in the leaves; potassium is found in the pods. Lime and magnesium increase in stems and leaves, while potassium concentrates in the seeds.

Lechartier gives the total weight of the mineral materials contained in 1000 Kilos of dry forage which is as follows :—

1 Kilo–2·2 lbs.

Mineral material.	Stems kilos.	Leaves kilos.	Pods kilos.	Entire plant kilos.
Proportion.	26·90	41·35	31·75	100·00
Ash.	12·91	50·87	20·50	84·28
Silica.	0·07	1·46	0·12	1·65
Phosphoric acid.	1·24	1·58	3·33	6·14
Sulphuric acid.	2·24	2·61	1·71	6·56
Calcium.	3·33	18·37	2·47	24·17
Magnesium.	1·91	5·40	2·16	9·47
Potassium.	2·13	4·01	7·45	13·59
Sodium.	0·20	0·07	0·89	1·16
Nitrogen.	2·05	7·08	10·00	19·13

CHAPTER XI.

Soya bean milk.

Milk recognised as the most valuable of food products.

From the earliest dawn of human history, milk has been recognised as one of the most valuable of food products. Millions of people in Asia, Europe and America find in milk and milk-products their principal source of nutrient. Milk is the indispensable food of the infancy and childhood. It is as indispensable for the adults as it is for the old. The cow is the earliest of the domestic animals. Back in the preglacial days, when the climate of Europe was very cold and trying, the Swiss lake-dwellers kept cattle; the milk of which along with the fish they could get out of their lakes, furnished their chief source of food. India from her glorious past, at the time of Lord Krishna, used to measure wealth by the number of cows a man possessed. People living on milk-diet are

generally free from disease. Central European races, especially the Bulgarians, have been given credit for being the longest lived of all the people of the Earth, as they live chiefly on milk and milk-products. Metchnicoff, the well known scientist, discovered that the age decay is largely the result of the absorption, into the system, of poison generated by the decomposition in intestinal canal. He studied the diet of the Bulgarian peasants, who lived largely on clabbered milk-milk fermented by adding a little of the clabber of the preceeding lot. These cultures are supposed to destroy the colon bacilli and other more highly toxic bactaria, that bread in the intestinal canal and thereby prevent their destructive action upon the delicate nerve cells and upon the general organism. The most virile and long-lived pastoral races of India and Arabia, the Rabaris and the Arabs, live on milk. John D. Rockfeller, the richest man in the world, offered a million dollars for a cure of his dyspepsia. He tried many European and American doctors, but to no avail. He was cured of his disease by a milk diet and outdoor life. He is

maintaining his present great age by living on milk diet.

The food value of milk.

The food value of milk can hardly be overestimated. It is commonly stated that one quart of milk equals in food value to any one of the following:—

2 pounds of milk equals	2 pounds of salt cod fish.
	3 pounds of fresh cod fish.
	2 pounds of chicken.
	8 eggs.
	6 pounds of spinach.
	7 pounds of lettuce.
	5 pounds of turnips.
	$\frac{1}{6}$,, ,, butter.
	$\frac{1}{2}$,, ,, wheat flour.
	2 ,, ,, potatoes.
	4 ,, ,, cabbage.

The composition of milk.

The chemical composition of milk (cow's) according to Henri B. Sherman professor of Columbia University, is as follows:—

Proteins.	3·3 per cent
Fat	4 ,,
Milk sugar	4·8 ,,

Citric acid	0·1	„	
Ash constituents	0·7	„	
Water	87·1	„	and

Albumen and casein of milk in abundance.

In mineral salts of milk we find sulpher, phosphorous, chlorine, potassium, sodium, calcium, magnesium, iron and iodine which help in supplying the nutritive elements to the brain and the nerve cells. Calcium builds the bones and keeps good teeth. Milk contains iron 0·00024%, yet it is rapidly absorbed and completely utilised by the body.

Fat in milk.

There is no richer and finer fat in all the world than butter. A drop of milk of the size of a pin head may contain 1,500·000 fat cells which explains why the fat globule of milk is perhaps the most easily digested and assimilated of all fats.

Vitamins in milk.

Milk is found to be the richest of all foods in the contents of vitamins. It contains vitamins A, B and D for the promotion of growth and reproduction.

Enzimes or "life" in milk.

It is commonly supposed that milk is not an active liquid, but possesses some indefinable principle or properties which are more or less characteristic of living tissues. Milk indeed possesses certain substances common to blood and other vital liquids such as antitoxins, agglutinins and other antibodies. Many of the cells in milk are, doubtless, not dead and in other ways, milk appears to possess "vital" properties.

Common dangers of milk diet.

Milk is the perfect body building diet. It contains all the ingredients necessary for the growth of the young baby. It promotes physical well-being and long life. Sir Robert Mac Carrison, Director of Nutrical Research Institute, Coonoor, South India, writes in his book on food:—

"The greatest nutrical need of India at the present time is the production of more and purer milk; for there is no more important food stuff than this, and none on which the public health is more dependent." But alas! the milk that we are getting in India is not pure

"I drink to the death of the whole table" the dangers of contaminated milk.

but is adulterated. In India 50% of the cattle are diseased. They are never medically examined and the milk of such cattle is mixed with the milk of other cattle. There is no municipal law which prevents selling milk of such cattle. No licenses are issued to milk-sellers for selling pure milk. Milk is adulterated with skimmed milk and dirty water in the villages from which it comes. The people, who bring milk in the cans, sell some milk on the way and add water to make up the milk they have sold. When it comes to bazar, the middle men add skimmed milk (milk from which cream and butter are taken away). Some take off the butter and cream while boiling, and then they sell the milk. Cities, therefore, are not only getting adulterated milk, but they are getting dirty adulterated milk. The cattle in India are housed badly and are not well cared for. They are given dirty water to drink and thus the milk becomes unhealthy. While milking, the udders are not properly washed. The vessels are cleansed by road side dirt, which may contain number of bacilli of any disease. When the milk comes to the bazar, it is

exposed to dirt and dust as well as foul gases. Even flies swarm about and fall in it. When the milk is served to customers, it is served in unclean pots. Milk on its way from village to the city and from the middle man to the customer is carried on in open vessels exposed to all dirt and dust. Milk, when it comes to Indian homes, is boiled in open vessels and it is left exposed to rats, cats, flies and dust. At times lizards drop into the boiling pans at the time of big dinners and have been found to cause vomitting, diarrhoea and sometimes even deaths of the guests.

Milk is the carrier of infection of many diseases.

Bacteria grow more rapidly in milk than in our bodies. Typhoid and diphtheria bacilli multiply at prodiguous rates. Under ordinary circumstances, the tubercle bacilli does not multiply in milk but remains active and virulent for months together. Therefore, a little infection in milk may increase and contaminate a whole supply. It requires only a spark to start a conflagration. Every time the milk is handled, there is an increase in the bacterial content. When a fly falls into it, it carries with it undesirable bacteria from

150 to 155 millions and brings in infection. Milk of the cow suffering from the tuberculosis of the udder in the form of softening nodules or abcesses will spread tuberculosis in those using milk, particularly the children. Milk is the carrier of scarlet fever, cholera, dysentery, and tuberculosis, foot and mouth diseases, Malta fever, septic scar throat, milk sickness etc."

M. J. Rosenau, professor of preventive medicine and hygiene, Harvard Medical school, U. S. A. writes in his book on milk question as follows:—

"The tragedies, that fill the front page o our newspaper that we read one day and forget the next, are not the real tragedies of life. Tuberculosis in one year claims more victims than the number killed by the bullets in four years of civil war. Of the 90 millions, living in U. S. A., 6 millions are doomed to die by the great white plague. Typhoid claims 25,000 and over 250,000 suffer from preventable infection each year. I name only these two diseases because they are sometimes spread by infected milk. Impure

milk conveys more sickness and deaths than perhaps all the foods put together. Milk conveys a great variety of infection than any other food. It is a food for bacteria; a very slight infection may result in wide spread epidemic. "Milk of all food stuffs is the most difficult to obtain, handle transport and deliver in a clean, fresh and satisfactory condition. Ignorance and apathy are obstacles in the way of milk supply and should be strongly wiped away to diminish the dangers. To fathom all its phases requires a comprehensive knowledge of bacteriology, chemistry, pathology, economics, sociology, animal husbandry, vital statistics, veterinary and medical sciences and kindred subjects. The rising generation must realise the importance of pure milk, to the well-being of the people and see to it that India shall become as enlightened with regard to milk production and milk distribution as other countries."

Soya bean milk.

In some of the countries of the Orient, China, Korea, Manchuria and in some parts of Japan, cow's milk is not consumed. They have got a belief that the cow's milk is meant

for the calf; and by drinking cow's milk, people may become like animals and may have horns. People in those countries prepare milk from soya beans and give it to their children to drink. Soya bean milk factories are to be found every where in these countries. The studies and researches made on this milk by the medical men of China show that the human skeleton and organism is developed normally and that the oriental people are not different in development from the occidentals. This milk is just like our ordinary milk, but has got a little farineous taste which can be improved by adding a little honey and vanilla. The Chinese philosopher, Whai Nain Tze, who lived 2000 years before the Christian Era is said to be the originator of the soya bean milk.

Korean methods of preparing soya bean milk.

Korean people passed immediately from a primitive condition to the status of an agricultural community without the intervention of the pastoral stage. It is for the very reason that the soya bean milk was the only milk used by the Koreans, upto the present day. Soya bean milk is much used in this country

as food, and as beverage in all the time of the year. Dr. Sohan, who is a native of that country, described soya bean milk preparation thus:—

"Dry soya beans are washed three times in water. They are then soaked in twice the volume of water for twenty-four hours. Heat is applied until the water is almost at its boiling point. The beans are ground thoroughly with water in a mortar. The resulting mass is then poured into a linen bag. The liquid portion is obtained by squeezing. The white filtrate thus obtained is soya bean milk."

Chinese method of preparing soya bean milk.

The beans are washed thoroughly with water. They are soaked in water for about twelve hours. The beans get bigger and softer. This facilitates the extraction of bean proteids. They are ground through a stone mill (chakki) which consists of two circular flat stones one on the top of the other. The top stone is turned round and round by hand against the lower one. The beans are put through the hole in the middle of the upper stone. By weight and pressure of the upper

stone, the fluid, which is pulpy, flows out between the two stones, and is collected in a tub. The crushed material is strained through a cloth and diluted with three times the amount of water. It is boiled upto the boiling point and strained. The white fluid comes out into a container which is soya bean milk.

The above two methods are used in small factories, that are seen all over the country. In China, soya bean milk is drunk by the Chinese early in the morning with some sugar added. This milk is used all over China for feeding infants and grown up children. In some big cities of China many factories are engaged day and night in manufacture of soya bean milk. It is a very pleasant sight to see in the Chinese street the vendors of milk running hurriedly to deliver soya bean milk bottles to regular customers in the early morning. Some Chinese mothers prepare fresh milk whenever they require it according to the following method:—

Home method of preparing soya bean milk.

Water is heated to the boiling point. Little by little soya bean flour is added constantly

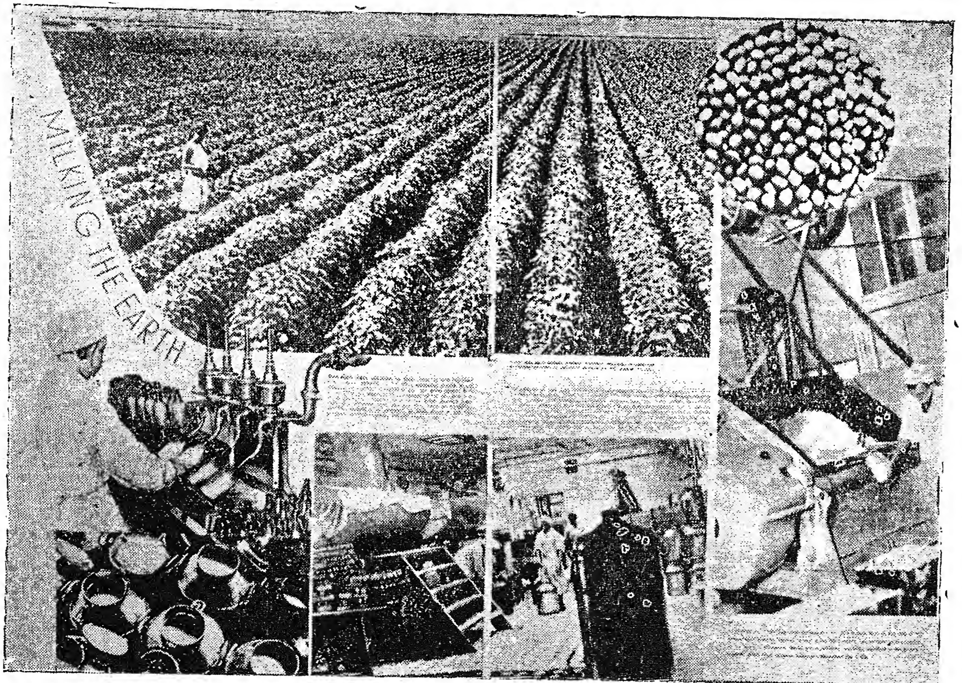
stirring so that it is properly mixed with water. The whole mixture is then boiled for ten to twelve minutes and then taken off the fire and strained through a cloth. The proportion is 1 part of flour to 7 parts of water. If thicker milk is required, the proportion of flour is increased or the water is decreased.

Soya bean milk and meat compared.

Soya bean milk, if kept at even temperature, will turn acid and co-agulate. Curds are formed exactly as curds are formed in ordinary milk. The Chinese make curds which resembles cheese. They call it "meat without bones." Its chemical composition is very similar to meat.

Medical properties of soya bean milk.

Soya bean milk protein is equal to protein in cow's milk. Scientific studies in Europe and America show that this milk is very easily digested from 95 to 100 per cent. Soya bean milk curds and flour are very excellent foods for children suffering from summer diarrhoea when they cannot tolerate other foods. It is easily digested, does not irritate the stomach and intestines, and so it



The biggest soya bean milk factory at Moscow (Russia)
showing the plant at work.

can be used in a number of ways, and is recommended by a number of medical authorities. Since it does not contain starch, (hardly 1%), it is the ideal food for diabetes, and is used as such by the physicians in Europe and America.

Experiments at the Children's Hospital at Boston Medical School showed that in a number of cases of eczema and asthma, where babies could not tolerate any milk and were given food in which the protein was supplied from soya bean milk, the eczema disappeared and they developed normally in asthma.

Comparison of soya bean milk with other milk.

Milk.	Water.	Ash.	Protein.	Fat.	Carbo-hydrates.
Soya bean milk.	87·03	0·52	2·40	3·15	6·90
Human milk.	89·95	0·25	1·30	2·50	6·00
Cow's milk.	87·30	0·80	3·20	3·50	5·20
Goat's milk.	87·00	0·50	4·00	4·50	4·00

(The above comparison is taken from the U. S. A. Agricultural Department bulletin.)

From the above comparison it is quite clear that soya bean milk compares very favourably with cow's milk.

Feeding experiments with soya bean milk.

Dr. Sohn B. S., M. D. at Korea made feeding experiments on rats for 69 days taking two groups of rats fed on cow's milk and soya bean milk respectively. The rats during the experiments were healthy and active and at the end of the 69th day it was found that 25·9 grams. of soya bean milk was required to produce a gain of one gram in body weight against 13·9 grammes of cow's milk required for the same purpose. None of the rats developed any avitaminosis. He concluded his result as follows :—

"Soya bean milk prepared in the Korean methods had approximately the same protein content as cow's milk. The other nutrient compounds were present in soya bean milk to a lesser extent than in cow's milk. The ration containing soya bean milk produced gain in weight, less rapidly than the ration containing of more ration per unit gain of weight.

Soya bean curds.

Soya bean curds, which is called 'Toffu' in Japan and 'Teoufu' in China is the same as our Indian curds. But it is more solid and keeps for a longer time if kept in water. When any acid is added to soya bean milk it co-agulates just like our ordinary cow's milk. A small quantity of magnesium chloride, about one per cent solution, which is previously dissolved in hot water is mixed thoroughly in hot soya bean milk. The protides are co-agulated through the action of magnesium chloride. The water that accumulates at the top is thrown away. The solid substance which remains under water is taken out and is put in wooden trays when it is warm. These trays are about three inches deep. Cloth is previously spread in it. The ends of the cloth are folded over the solid substance and a board is placed upon it. Weights are put by piling several trays one upon the other, and on the topmost one-some heavy weight-a stone slab is put. After the water has been pressed out sufficiently, the cake of the soya bean curds is solid enough to stand handling. It appears like

cream cheese. This toffu is rich especially in protein, fat and mineral salts. It forms a valuable diet for the Buddhist monks as well as the strict followers of Lord Budha who partake of no animal food. All the protein, which is supplied by the animal food in the diet of the people of the west, is supplied by toffu in the diet of the Chinese, Japanese and Koreans.

Digestibility of Toffu.

According to Dr. Oshima a Japanese scientist, who made extensive investigations in 1905 regarding the co-efficients of digestibility 65% of protein, 93% of fat and 90% of carbohydrates were found to be digested by his subjects. This toffu enters into the manufacture of various delicious dishes of the Chinese and the Japanese. The recipes of these dishes are given in a separate chapter at the end of the book.

Condensed vegetable milk.

Japan is the greatest manufacturer of the vegetable condensed milk which is prepared as follows:—

Soya bean milk is prepared as above. Sugar is added in the proportion of 1 to 8

and the fluid is poured into a great pan and the water is evaporated. This milk resembles cow's milk in nutritive qualities and appearance.

Soya bean milk casein.

Soya bean milk casein is prepared from cake or milk after the oil has been extracted from the bean. The cake is ground under a mill stone. Cold water is added. The whole homogenous milky material thus obtained is passed through filtered press and the milk is obtained. This milky fluid is poured into cylindrical wooden vats and is heated to the boiling point. One kilogramme of calcium sulphate is added to each thousand litres of liquid. This causes the precipitation of vegetable casein, which accumulated on cloth filters. It is then dissolved in dilute soda lye, weak enough for reaction to the slightly alkaline. Then after filtering it is precipitated with acetic acid, left to evaporate in the open air and the precipitate is then dried at a low temperature. 25 grammes of casein can thus be had from hundred grammes of soya bean cake.

Uses of soya bean casein.

Soya bean milk casein is used like animal milk casein and for industrial purposes. It is used like 'Nestle's' food under the name of soya bean casein. For industrial purposes, soya bean casein is used as a medium for paints and varnishes, for sizing papers, cloths and textiles. It enters into the manufacture of water–proof goods. All the toys that we see in the Indian market are made from cellulide which in its turn is made from casein.

Digestibility of soya bean casein.

It is the general opinion that the vegetable casein has a much smaller coefficient of digestibility than that which animal casein has. Doctors H. Labbe and Marchaoisne made extensive investigations re: the digestibility of vegetable casein. They concluded that vegetable albumen is as readily assimilable as animal albumen. Vegetable casein differs somewhat from animal casein but even the same difference exists in the casein of the various animals. In America, soya bean milk is much used for cooking purposes. This milk enters into manufacture of bread,

cakes, pastries, chocolates and all sorts of confectioneries. There are two soya bean milk factories in Europe; one is in Holland and the other is in Russia.

The need of soya bean milk in India.

In India, milch animals are half starved. In European countries and in America, milk is sold cheaper than in India. The milk in those countries is much richer in fat and other nutrients than in india. There is no sanitary or municipal control in India as in the west. No license or permit is given to the vendors of milk and no milch animals are examined by the veterinary surgeons. All these lead to the universal practice of adulteration and the spread of epidemic in India. The contamination of milk is, therefore, of common occurence. It is also beyond the means of millions of people of India to buy even the dirty milk, sold in the bazar. It is, therefore, very essential that we should manufacture soya bean milk in India. On account of its high nutritive value and the phosphates contents, it is good for infants and children. The cost of this milk will not exceed one pice ($\frac{1}{4}$ anna) per pound.

The author has fed his own baby on soya bean milk with satisfactory result. Dr. Tilak, the honorary Secretary of Bombay Presidency Baby Health Week Association, tried soya bean milk at Matunga Orphanage. The children grew rapidly and did not show any other sign of nutritive decline. Soya bean milk was also freely distributed to the infants of the poor people in the vicinity of the author's home, and it produced satisfactory results. When the children once take a liking for it, they ever afterwards relish the vegetable milk.

Major General Sir Robert Mac Carison Lt. Director of Nutritional Research Institute, I. R. A. F. Coonoor, writes :—

"Soya bean is one of the few seeds containing three vitamins, A, B, D., which is indispensable in the staple food consumed by mankind and necessary also in food for cattle. I would advise you to advocate the use of ' Soya bean Milk ' for infants and young children, who cannot obtain sufficiency of mother's or cow's or other milk.

The author s own child 3 months' old fed on soya bean milk,

CHAPTER XII.

Soya bean flour.

Soya bean flour.

It is quite essential to understand what is meant by soya bean flour. In this chapter, the word soya bean flour means flour obtained by grinding the beans. By soya flour, it is not meant the flour of the cake or meal after the extraction of the oil.

Disadvantages of the extracted soya flour.

In the process of the extraction of oil from the beans, the vitamin A is destroyed. The protein bodies in the beans get deneutralised owing to their long contact with the fat extractor. Some of the aromatic substances, as well as, the palatability are evaporated by the heat of the machinery. The residue after the extraction of the oil, is devoid of fat soluble vitamins, and is inferior in nutritive value to satisfy all the requirements of the human body. No doubt, it

contains mineral salts and other elements but that is not enough.

Lecithin in soya flour.

Soya flour contains lecithin more than any other flour. It enhances the nutritive value of various food stuffs to which soya flour is added. It is used in the cure of nervous diseases. The lecithin in soya flour is according to Dr. Jean Freud, identical with that in the egg yolk. (Press Medicale No. 6 January 19, 1927.) This lecithin is destroyed by the process of milling. In short the biological value of soya flour is affected by the extraction of the oil. It is better, therefore, to make use of the whole soya flour instead of the meal or cake residue from the soya bean.

Comparison of soya flour with other flours:—

Food.	Protein%	Fat%	Carbohydrates%	Ash%	Calories value%
Soya flour.	40	20·3	24·6	4·8	2,100
Wheat ,,	12	1·7	73·7	1·5	1,750
Bajari ,,	10	5	74·2	2	1,750

Food.	Protein%	Fat%	Carbohydrates%	Ash%	Calories value%
Jowar flour.	8·9	3·1	71	2·5	1,750
Rice whole.	7·5	1·8	82	0·8	1,384
Gram flour.	19	4·3	54	2·8	1,530
Lentils.	25	1·5	60	6	1,600
Peas & beans.	24	1·5	60	3	488
Maize flour.	10	4·3	73	1·8	1,700
Rye ,,	12·2	1·5	73·9	2·3	1,750
Oat meal.	11·8	5·0	69·2	2·0	1,720
Meat.	24	2·5	...	1·5	576
Eggs.	14·8	10·5	...	1	720

(Compiled from Bombay Presy. Baby and Health week Association and others).

From the above table it is quite clear that soya bean flour contains the highest amount of protein, fat, mineral salts and the least amount of starch, in the molecules of carbohydrates. Soya flour possesses the highest nutritive, as well as, caloric value. It contains fat soluble and water soluble vitamins. The proteins in soya flour are of high biological value and can safely replace the costly animal food. Soya bean food contains more than

double the amount of protein than meat. Wheat flour is deficient in protein. It contains less than 2 per cent fats. The vitamin content is negligible. There is an excessive amount of starch in wheat. In order to avoid all these deficiencies, we must add soya bean flour which is rich in protein, fats, mineral salts and vitamins, and which is poorer in starch. Protein in soya bean flour compares very favourably with the chief sources of protein viz. milk, fish, chicken and eggs.

Soya bean flour contains about 4 times as much protein as any other cereals and 5 times as much as that of rice.

The fat content of soya bean flour.

Soya bean flour contains from 15 to 20% fat depending upon the variety of the beans. Its fat content is 20 times higher than wheat, bajari and jowar, which are said to be deficient in fat. The fat in soya bean flour is of higher biological value and contains vitamins A and D.

Mineral contents of soya flour.

Soya flour contains abundance of mineral salts, viz. potassium, sodium, calcium,

phosphorous and iron. Soya flour is a boon to the vegetarians as bulk diet of starch and carbohydrates is supplanted by the proteins and fats of high biological value.

All the mineral deficiencies in the vegetarian diet will be made up by the soya flour diet.

Cost of soya flour protein.

Soya flour is reasonably cheap. It absorbs more water than wheat flour or any other flour known so far; and so it is more easily digestible. Its coefficient of digestibility according to Oshima, is 95·7%. From nutritive, physiological and economical stand point soya bean flour can be used in sufficient quantity in our daily diet. As stated in chapter I of this book, the dietaries of the people of India are defective and in order to make up the deficiency, it is quite essential to consume in greater quantities milk and milk products, fresh fruits and green and leafy vegetables, meat, fish, chicken and eggs if religion permits. But economically, millions of people in India cannot afford to provide for these costly food products. Soya bean flour will, therefore, furnish them

with protein, fat, and mineral salts at a reasonable cost. Even the poorest of the poor can afford to buy soya flour because it is within the easy reach of every one.

Food problem of prime importance.

There are numerous problems of life, but the problem of food is of prime importance in a country like India where the mass population is poor, and where the average per capital is very low. The question of national nutrition therefore, cannot be tackled unless there is co-operation from the Government and the people. Such questions can never be solved by mere theoretical considerations; but great results can be achieved by practical experiments, in nutrition. These experiments should be carried out, not only in the biological laboratories, but also in reformatories, prisons, orphanages and hospitals, where we can see their results on human beings of all descriptions.

Experiments of soya flour in Austria and Czechoslovakia.

Experiments of soya flour were carried out on infants and children in Austria and Czechoslovakia, by giving half of their protein

requirements in the form of soya flour. These experiments were carried out for a considerable length of time with most satisfactory results.

Dr. Rurah in 1910, carried on sufficient feeding investigations extending over 6 to 7 years on infants and children. He states that a gruel made of 1 to 2 level tablespoonfuls of soya flour to a quart of water was found very valuable in checking summer diarrhea and certain forms of intestinal disturbances. He states that it is well borne and digested by children and decreases vomitting and nausea. In his further investigations, Dr. Rurah states that a mixture made of soya flour gruel and condensed milk is the best food for infants when the infant is incapable of digesting cow's or buffalo's milk. In cases where the milk supply is objectionable or where fresh milk cannot be had or where the milk is dear and not within the means of the poor people to buy, this mixture can safely be used. It permits a perfectly normal development as far as bones and muscles are concerned and they present the appearance of breast fed dishes. The author fed

his own baby on the above mixture for a period of nearly two months and found it very satisfactory.

Experiments of soya flour in Bombay.

In Bombay at the Matunga Orphanage, Dr. Tilak the Honorary Secretary, Bombay Presidency Baby & Health Week Association carried for some time past, soya flour experiments in the diet of the children of the Matunga orphanage. Usually 20% of soya flour was mixed with the wheat or bajari flour and roti or bhakari made, which was given to the orphans. They were fed with this food morning and evening, with excellent results. All the children were healthy, rapidly developing in body stature and did not show any sign of nutritive decline.

At the Parsi orphanage, at Bombay, soya bean flour is added to the wheat flour with equally satisfactory results.

Roti the food of India's millions.

If we study the dietary of India we find that more than 80% of people consume roti or chapati in some form or other. The people of the Punjab, U. P., Behar C. I., Sind, Rajputana C. P. and Berar consume

wheat roti. People of Gujarat and Deccan, Nizam's domain, and some parts of Kanara district consume partly wheat, Bajari and Jowar rotis. In Mysore and in some parts of Madras ragi roti is very common. West coastal lines of India, Konkan side people eat Patni roti of Jowar and rice mixed together. The majority of the people in India eat roti or chapati or bhakri at every meal.

Introduction of soya flour mixture in roti and its advantages.

Soya flour will enhance the nutritive quality of Indian rotis. Less ghee or oil will be required as there is 20% of fat in soya flour. The palatability of roti will be much better than the ordinary roti. The texture and the colour of roti will improve. The keeping qualities of roti will also be improved and it will last for a longer time without being spoiled. By adding soya flour 15 to 25% to our ordinary roti it will not only improve in nutritive quality, but it will also improve in digestibility. There will also be a saving of oil and ghee on account of the sufficient fatty content in soya flour. It will keep roti or chapati soft.

Soya flour will enter into preparation of tasty Indian dishes.

On account of the above qualities of soya flour, it will find its way into the household preparation of India. Many tasty dishes of soya flour can be made. All varieties of sweetmeats which the Indians relish very much can also be made from soya flour.

SWEET DISHES.

1. Laddus all sorts.
2. Vadis " "
3. Halvas " "
4. Jalebis.
5. Khajas.
6. Magaj.
7. Suterphenis.
8. Pakas.
9. Gulabjambus.
10. Rasgullas.
11. Papadam, a Madras dish.
12. Cocoanut pak vadi.

PUNGENT AND SOUR DISHES.

1. Bakhar vadi.
2. Patvadi.
3. Khaman Dhoklas.
4. Shev all sorts.

5. Gathia.
6. Bhajis.
7. Kachauris.
8. Chevda.
9. Papad.
10. Vadi.
11. Shevya.
12. Papadi.
13. Ravan Bhat a Madrasi dish.

Simple dishes such as :—

1. Puri, rotti, Bhakri, Rotla.
2. Shankar Palas.
3. Mudake.
4. Kodboles.
5. Thali Pith.
6. Beshans all sorts.
7. Idli Dosha, a Madras dish.
8. Shegole.

Soya bean flour serves as liason or binding in Indian curries, Kadhis and sarram and in vegetables. As stated in the chapter on milk, vegetable soya bean milk can also be prepared from soya bean flour by adding seven times the amount of water and by boiling it for 7 to 10 minutes.

How to prepare Indian dishes out of the soya flour will be dealt with in the chapter in recipes on Indian dishes. All milk products and sweetmeats prepared from them can be made from this soya bean milk also. All milk products and sweets prepared therefrom can be made from soya bean milk.

Diabetes and soya flour.

Soya flour is of great value in the diabetic dietary. It is starchless. Its sacchides content is very low. The carbohydrates are in such form as to give energy without being provocative to the appearance of sugar in the urine. This is the cheapest food for the diabetic patients. The cost of artificial diabetic flour is about ten times higher than soya flour.

Soya flour compared with other flours of diabetic dietary.

Flours.	Carbohy-drates.	Protein.	Fat.
Soya flour.	14%	38%	20%
Casoid milk.	...	28	17
Prolacts.	Nil.	32	15
Gluten flgur.		77	6
Almond flour.	3·5	24	57
Energen flour.	0·5	22	...
Bismeal.	67	33	5
	43		

The caloric value (100 grammes = 469 calories) is much higher than that of other diabetic flours. Dr. Jozeb Szanto writes in his article "Soya flour in the treatment of diabetes" which appeared in the "Therapie" a Hungarian Monthly, wherein he states that in the kitchen of the sanitarium under his charge soya flour was daily used in various diabetic dishes with excellent results. The author knows of three diabetic cases over here living on roti made of soya flour and gluten mixed. Each patient is taking milk curd and butter milk daily and vegetables. All the three patients are doing well. One of them is a rich merchant while the other two are Government servants. All of them attend to their business and are never in bed. One of them said to the author the other day, that, were it not for soya flour, he would have been dead long ago.

In 1910 Friedenwald and Rurah after a series of experiments came to the conclusion that soya flour is a valuable addition to the diabetic dietary on account of its low starch content palatability and the numerous ways in which its dishes can be prepared. They

also found out that soya bean causes a reduction in the percentage of sugar passed in the diabetic subjects.

The medical science has long recognised the value of the soya flour, in the diabetic dietary and doctors all over the world prescribe soya bean regime for their patients. The Menus for the diabetic patients are given in the chapter of the recipes.

European cookery and soya bean flour.

Soya bean flour can be made use of in the whole realm of European cookery. For centuries bread has been the staple article of diet of millions on either side of the Atlantic. The bread is made from the white flour. As stated before even wheat is deficient in protein and fat and its proteins are incomplete proteins. This applies with much greater force to white bread. In the manufacture of the white flour all the bran and germ, the most nutritive and valuable portions of wheat, are removed. These parts contain the best of proteins and most of the mineral salts. The vitamins are destroyed by the mill roller and by the heat of the machinery. Only the starch, the carbohydrates and negligible

amount of unsuitable proteins are left in the white flour. One important mineral largely lost in the manufacture of the white flour, is manganese which is growth promoting. The white flour is thus very inferior to whole wheat flour, "Atta" as the staple article of diet. Roti and chapati or Bhakri made from the whole wheat flour or Bajari or jowar flour or ragi flour mixed with soya bean flour is much superior in nutritive value to the bread from white flour. In recent years great propaganda has been carried on in Europe and America against the use of the white flour bread. But it would take very long time before the majority of the people use whole wheat or brown bread. People even in advanced countries of the West, stick to their customs and traditions. Nutrititive considerations is put aside for the aesthetic reasons viz. colour and tastes etc. A staple article of diet should be as perfect as possible from the physiological, biological and nutritive point of view. The white flour bread is deficient in so many respects and it does not fulfil any of these conditions. The introduction of soya flour, therefore, will make up the above deficiency

and will enhance the nutritive value of bread; besides it will bring about a great economic gain in saving ghee, butter and eggs etc., This is not all; but the digestibility, the keeping quality and the texture will also be improved.

Digestibility of soya flour.

Bowers in 1919, made rather extensive investigations on the nutritive value and digestibility of soya flour. He states that "The protein of flour, if properly cooked is 91% digestible, carbohydrates 94% digestible, starch which is one per cent is completely digestible, hemicelluloses which is nearly 6% is 93% digestible, calcium oxide 0.27% and phosphorous petroxide 1·52% are thoroughly digestible. How a mixture of soya flour in wheat flour increases the nutritive value of bread, is given in the following tables. In England, bakers mix from 10 to 15% of soya flour in ordinary bread, biscuits and pastries In Italy and France 20 per cent flour is mixed with the bread to give it a required colour and texture. In India 15 to 25 per cent soya flour may be added with great advantage.

Care should be taken to get fresh soya flour ready every week.

The following table gives the comparative analysis of ordinary white bread and bread made from the same white flour with 10 per cent of soya flour, by Dr. Campbell.

	Dry solid white breads.	White bread with 10% soya flour.
Protein.	12·25	15·75
Fat.	1·40	3·26
Starch.	79·15	72·23
Soluble carbohydrates.	5·25	6-36
Fibre.	0·50	0·60
Ash.	1·45	1·80
	100·00	100·00
Vitamins A. B. D.	Absent.	Present.
Organic Phosphoric compounds Lecithin.	Absent.	Present.

The increase of ash is mainly potassium phosphate.

The following table also shows how the food value increases by the addition of soya flour.

	Protein on dry solids.
Whole meal bread without soya flour	14·50%
„ „ „ with 5% soya flour	16·25%
„ „ „ „ 10% soya flour	18·00%
„ „ „ „ 20% „ „	21·25%
White bread without soya flour	12·25%
„ „ with 5% „ „	14·00%
„ „ „ 10% „ „	15·75%
„ „ „ 20% „ „	19·25%

From the above table it is clear that the addition of soya flour enhances the nutritive value of the flour with which it is mixed. To get flour the beans should be dried in the sun for two days. The thin husks should be thrown away or given to the cattle for feeding and the pulses are to be ground into flour.

CHAPTER XIII.

Industrial uses of soya bean.

Uses of soya bean oil.

Soya bean oil is very important in the world's market on account of industrial value. Oil is used daily in cooking vegetables and dressing salads, in China and Japan. It enters in the manufacture of lard, margarine, salad, oils paints, varnishes waterproofs, soap, glycerine, printing inks, celluloid goods explosives, immitation rubbers etc. In the interior of China, it is used for greasing the native machinery and for lighting purposes. It also enters in the manufacture of food products. It serves as a substitute for olive oil, when there is scarcity of it, in the world's market.

Characteristics of the soya bean oil.

Soya bean oil belongs to the semi-drying class of oils. It is light yellow in colour, tasteless and odourless. It resembles to some

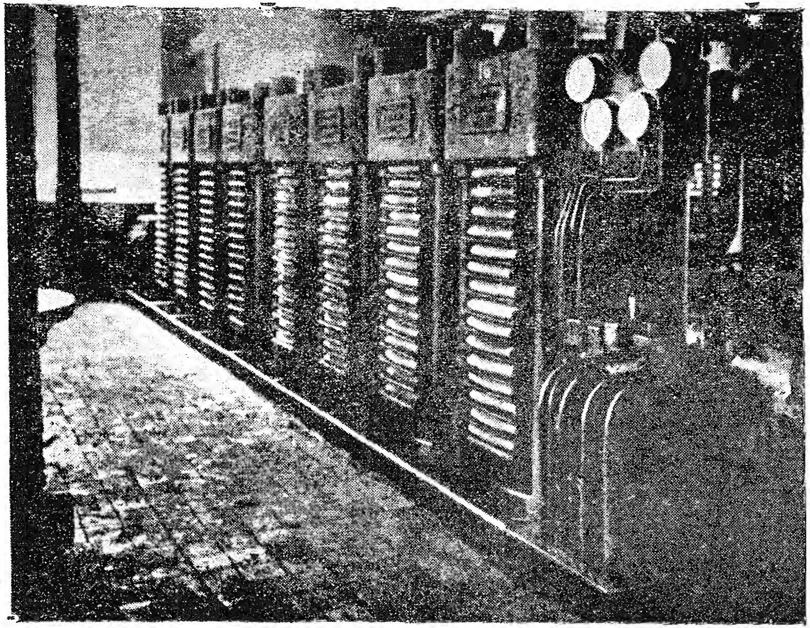
extent the cotton seed oil in colour and appearance.

The solvent method of oil extraction used in European countries.

In most of the European countries the solvent method of oil extraction is used. This involves the use of benzine and gasolene, as the solvents. The beans are first crushed and then treated by the fat solvent. Oil is taken out by evapourating the solvent. This is destilled and used over again. The residue is well dried and used as fertilizer. This method is used when the oil is required for industrial purposes. When the oil is required for cooking (food) purposes, chemical processes are not used as the solvent gives a special kind of odour to the oil. This odour cannot be entirely removed from the oil. In America, they use hydraulic and expeller process for oil extraction.

The Chinese method of oil extraction.

It is as primitive as the oil extraction method of the local oil in India (Ghanchis.). Beans are first crushed under mill stones. They are then placed in gunny bags over a wooden grating which are laid upon pots of



Soya bean oil pressing mill worked by hydraulic power.

boiling water. They are steamed in this manner for fifteen minutes. The resultant mass is then spread out in circular frames about six inches deep. Five of these frames are placed one above another in a verticle press. This press consists of frames upright with cross beams at the top, and at the bottom. The pressure is then applied by means of wedges driven in between the cross beams and the beans are pressed on the top of the frame. Oil is thus extracted and it flows out and is then collected in a tank. The yellow bean varieties are richer in the oil content than the other varieties. It is to be noted here that the method of oil extracting in China involves four processes; 1. crushing, 2. steaming 3. preparing for the press, and 4. pressing.

Price of soya bean oil.

The price of soya bean oil is determined by the prices of other oils in the market. At present soya bean oil is at par with cotton seed oil, cocoanut oil etc., it is sold from 7 to 9 rupees per maund of 40 lbs.

Uses of soya bean oil.

The soya bean oil is used for making soft soaps. It has displaced linseed oil in that

respect. By the use of hydrogenation process, soya bean oil is used in the manufacture of hard soaps. Soap industry is the largest single consumer of soya bean oil. Soya bean oil is used also in the manufacture of glycerine and candle making.

Artificial rubber made from soya bean oil.

All the world over the people have to depend for their rubber supply upon rubber plantation in Malaya, Java, Strait Settlements and Ceylon. But this difficulty has been solved by two German scientists using soya bean oil as the raw material for artificial rubber. Soya bean oil is converted into a glutinous vicid product by nitric acid. The whole mass is thereupon treated with diluted alkalies. This is then treated to a temperature of 150 degrees thereby changing it to a tough and elastic material. This resembles rubber. It can be given any shape by mechanical handling like the Caoutchouc. Japan after the discovery of this imitation rubber is at present manufacturing various rubber substitutes like toys, shoes, tyres, and so many other articles of industry.

Yield of the oil.

One ton of the beans will yield by the expeller process 32 gallons of oil and 1600 lbs. of cake. The difference of 130 lbs. represent the loss due to cleaning and the evaporation of mixture after the beans have been crushed and heated. The cost of extracting oil is cheaper like cotton seed crushing.

Method of shipping.

In oriental countries the oil is shipped in 5 gallons tin cans or in barrels while in U. S. A. the oil is carried in tanks.

Consumption of soya bean oil, in soap manufacture in U. S. A. compared with other oils (figures in lbs.).

Kind of oils.	1912.	1914.	1917.
Soya bean.	71,182,000	4,449,000	124,058,000
Cocoanut.	78,816,000	77,959,000	168,602,000
Cotton seed.	132,312,000	119,254,000	126,390,000
Linseed.	1,390,000	1,034,000	1,006,000
Peanut oil.	31,000	76,000	15,126,000

Soya bean oil and glycerin.

Soya bean oil has been found most useful on account of the low content of its free fatty acids and unsaponifiable matter. When properly refined soya bean oil yields about 10% glycerin as by-product in the manufacture of soap. This glycerin has been found to be equal in value to that received from other soap-making fats, such as tallow, cotton seed oil, coccanut oil etc. This glycerin is subsequently destilled for use in manufacturing explosives such as dynamites, cordites and blasting.

Soya bean cake.

Soya bean cake or meal is the residue which remains after oil has been extracted from the beans. It is highly nutritious as it contains considerable amount of protein, and abundance of mineral salts. It is used as a fertiliser and as a feed for the live-stock in Manchuria and Japan. The use of meal as flour for human consumption on account of its highly nutritious properties is getting very popular on both the sides of the Atlantic. Series of investigations made in Europe and

America indicate the high feeding value of this meal, for all kinds of farm-stock. It is used for the fattening of the animals. The low price of the meal in comparison with the other feeds has made it popular among dry countries, of central Europe. In America it is considered as the best food for fowls, cattle, horses and dogs, and all kinds of animals. The meal is turned into food for invalids and old. It is also considered the best food for infants. At the Armstrong College in England, Gilehrist conducted feeding tests on animals regarding soya bean milk, and cotton seed cake. He states that in case of the soya bean milk, milk production increased. Cows put on more weight. The fat content of the milk was relatively constant. The Royal Agricultural College in England also conducted a feeding test on the same line with identical result. In China people roast the cakes and eat them in times of famine. This proves the high nutritive value of soya bean meal or cakes.

Soya bean milk for hogs.

Extensive experiments were conducted qy Wheeler, Grey, Skinner and others in

America in determining the feeding value of soya bean meal when given to hogs. They have come to the conclusion that for rapidity and economy of the grains soya bean meal is superior to any other meal as part of the ration for hogs. In England experiments were carried on, on sheep and lambs with satisfactory results.

Soya bean meal for fowls.

Kaupp of the North Carolina U. S. A. Experimental Station, conducted feeding experiments on chicks. He reports that soya bean meal proved to be the most valuable feed and one to be recommended as good ration for feeding small chicks.

Soya bean as a fertiliser.

From the standpoint of the fertilisation soya bean meal is the richest for plant nutrition than any other meal known so far. So for centuries it has been used as the manure in sugar growing regions of southern China. In Manchuria large amount of soya bean manure is used to improve the poorer soils. In Japan large amount of cake manure is used in rice fields.

Digestibility of soya bean meals.

In point of digestibility soya bean meal compares very favourably with other meals.

Kind of meal.	Protein %	Fat %	Nitrogenous free extract p. c.	Fibre.	Total digestibility %	Assimilability %.
Soya bean...	41·6	41·4	27·6	5·5	97	96
Cotton seed	39·7	8·4	15·3	2·0	76	97
Linseed	32·2	3·4	26·2	4·5	78	96
Peanut	40·0	8·3	20·0	0·8	83	98

The following is the comparison of soya bean meals with other important oil cake feeds.

Constituent per cent.

Kind of feed.	Moisture.	Protein.
Soya bean Meal U. S. ...	7·59	44·65
Soya bean cake	17·37	44·00
Cotton seed	6·62	40·29
Linseed	9·63	37·51
Peanut	10·73	46·84

Fat.	Nitrogen free extract.	Ash.	Fibre.
8·77	27·12	5·89	5·98
7·00	21·12	5·52	4·98
7·41	28·63	6·21	10·84
2·49	36·09	5·54	8·74
7·91	24·34	4·89	5·29

Fertilising constituents of soya bean meal.

The fertilising constituent of soya bean meal is as follows:—

Kind of fertiliser.	Nitrogen.	Ammonia.	Constituent% Phosphoric acid.	Potash.
Soya beans.	6·51	7·90	1·36	1·82
Soya bean cake.	6·77	8·23	1·33	2·00
Soya bean meal.	7·24	8·79	1·44	1·85
Cotton seed meal.	6·79	8·24	2·88	1·77

CHAPTER XIV.

Enriching soil by addition of nitrogen and the use of Soya Bean as fodder.

Prof. N. R. Dhar, President of the National Academy of Sciences, addressed the fifth annual meeting of the National Academy of Sciences presided over by His Excellency the Governor of the United Provinces, the patron of the academy.

The president stated at the outset that as the Academy was the first to be started in India with an all-India outlook and fellows and members residing all over the country, the members of the Academy had unanimously decided to adopt the name " The National Academy of Sciences " and to increase the number of fellows to 150.

" It is well known, that crop production in India is quite inefficient in comparison with the yield in other countries, as is evident from the following figures :—

Rice: India 1,295 lb. per acre; Japan 3,040 lb. per acre; Egypt 2,783 lb. per acre.

Sugar: India 2,400 lb. per acre; Japan 3,340 lb. per acre; Egypt 3,378 lb. per acre; Java 11,988 lb. per acre; Hawaii 18,799 lb. per acre.

The Professor continuing said :—

"This poor yield is mainly due to the deficiency of nitrogen in the Indian soil which contains only 0·04 per cent. nitrogen as against 0·1 per cent. present in the soil of European and other cold countries. It is gratifying to note that the Indian soil generally contains plenty of potash, lime, phosphate and other necessary plant food materials. In order to improve the crop yield in India we must increase its nitrogen content. Unfortunately the Indian peasant is too poor to purchase artificial nitrogenous compounds imported from foreign countries as there is no nitrogen industry in this country ".

MOLASSES AND NITROGEN.

The researches of Prof. Dhar and his collaborators notably Drs. C. C. Palit, Gopala Rao, A. K. Bhattacharya, Messrs. S. P. Tandon, Atma Ram, N. N. Biswas,

S. K. Mukerjee and E. V. Seshacharyulu have definitely established that nitrogen is added to the soil by the application of molasses. The sugars present in the molasses combine with the oxygen of the air with the help of bacteria, sunlight, and substances like iron, manganese, etc. which are always present in the soil.

In this process of oxidation (combination of sugars with oxygen) large amounts of energy are set free and this energy is utilised for the combination of the nitrogen and oxygen of the air forming nitrates and ammonia which are excellent plant food materials, the free nitrogen of the air cannot serve as food for most of the plants except soya bean. Molasses not only adds nitrogen to the soil but also increases its humus content and the beneficial effect lasts over two years.

CROP YIELD INCREASES.

Prof. Dhar and his colleagues have been able to increase the soil nitrogen by hundred per cent on the addition of molasses. The crop yield has also been considerably increased in the molasses fields in comparison

with the controls. Rice is highly benefited by the application of molasses, molassed land producing 14·5 maunds per acre as against 8·1 in the unmolassed field. The straw is also greater in the molassed than in the unmolassed field. Messrs. Parry and Company of Madras, and the Government Shahjehanpur Farm have obtained an increased yield of 40 per cent. with molasses as manure in sugar cultivation.

Prof. Dhar has made it amply clear that molasses must not be added to the growing crop, but should be added to the fields two to three months before the sowing of the crop. After the application of the molasses the soil should be ploughed three or four times before the sowing, watering the soil is just the same as in ordinary cultivation. Prof. Dhar and his collaborators have always found that the moisture content of the molassed field is greater than the unmolassed.

In cold countries the soil temperature being low and due to the lack of sunshine, the sugars present in the molasses do not combine with the oxygen easily and hence the

energy available from this process is too small for any nitrogen addition to the soil in temperate climates.

AMMONIUM SULPHATE.

The results obtained by Prof. Dhar and his collaborators with the artificial fertilizer ammonium sulphate added to the soil with and without molasses show that the nitrogen of the molassed plots is always greater than that of the unmolassed ones. Hence molasses can act in the conservation of soil nitrogen. In tropical countries, a mixture of molasses and ammonium salt is a better fertilizer than ammonium salt alone.

The researches of Prof. Dhar and his collaborators show that for the reclamation of alkali soils molasses can be very usefully applied. It is well known that molasses contain between 60 to 70 per cent. of carbohydrates (sugars) 4·5 per cent. potash, 2 per cent lime, 0·5 per cent. phosphoric acid, 0·5 per cent. iron and aluminium oxides and 0·5 per cent. combined nitrogen and the rest water. Moreover, molasses is distinctly acidic.

Research work carried on in Allahabad, Bangalore, Java, Hawaii and other sugar producing countries shows that when molasses is added to the soil, along with carbonic acid, organic acids are produced in the early stages in the decomposition and partial oxidation of the carbo-hydrates present in the molasses. The acids thus produced together with the acids present in molasses can neutralize the alkali of the soils rich in alkali.

The soluble calcium salts are helpful in the improvement of the soil tilth by their flocculating power on the clay particles. Moreover in the presence of soluble calcium salts, the permeability of the soil is greatly improved. The results of Dr. Dhar and his collaborators show that molasses is a better reclaiming agent for alkaline land than either gypsum or powdered sulphur, as there is nitrogen loss from soils when these latter reclaiming agents are added to alkaline soils whilst molasses adds nitrogen.

Alkaline lands have been successfully reclaimed in different parts of the United Provinces and in Mysore by the application

of molasses, and good crops are growing in these reclaimed areas where no vegetation ever grew.

Soya bean crop enriches soil with nitrogen.

The crop conference of the Agricultural Department of the Government of India held at Delhi last May 1935 recommended that soya bean should be tried as a rotation crop as nitrogenous bacteria is present in the soil throughout where soya bean is grown. It not only improves the soil but increases the field of the crop also.

Rotation experiments carried on in Baroda territories at Achisara proved that the cotton yield after soya bean crop was nearly double that of the land where crop was not rotated in soya bean.

Soya Bean as a live stock feed.

Soya bean hay is very nutritious as a live stock feed on account of its high content of digestible nitrogen. The comparative feeding tests carried on in America with clover, alphafa, cowpea and lucern shows the superiority of soya bean fodder to all others in point of production of milk and butter. It has been our experience that cows give more

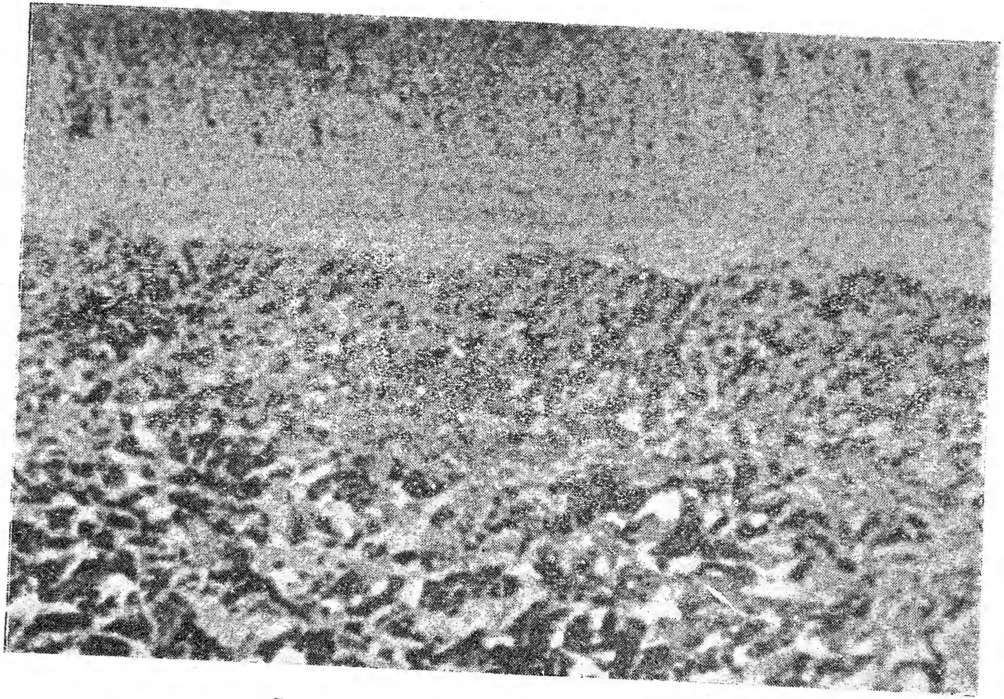
milk and put on more weight when fed on soya bean hay.

It has been found at the Baroda Agricultural experimental station that the bullocks showed great strength and agility and put on more weight when they were fed on soya bean hay. The reports received from the various experimental stations in India viz Pusa Poona, Coimbatore, Sakarkand, Punjab, Berar, Central Provinces, Indore, and Madras all show that the fodder type variety succeeds very well in all the provinces in India. The yield of the hay is nearly 4 to 5 tons per acre and that of the seeds from 12 to 15 maunds per acre.

Considering the yield and the high content of protein and the soil which is improved by its cultivation as well as considering the problem of fodder which it is going to solve in India, we recommend its cultivation.

Green manuring.

The soils that have deteriorated by continuous nitrogen yielding crop may be restored back to its productivity by the use of the leguminous crop like soya bean.



:Soya Bean grown at Sakarkand (Sind).

SOYA BEAN.

This crop by the aid of the soya bean root tubercle organisms is able to add to the nitrogen of the soil. Hence it should be extensively used in restoring the soil that are deficient in that element. The green crop before it ripens to pod formation should be turned down and covered over with earth so as to allow it to decay. In this way the nitrogen of the plant is mixed up with the soil thus increasing its productivity.

CHAPTER XV.

Food requirement of the human body.

Before beginning the next chapter on recipes it would not be out of place to mention here the principles governing the dietary requirements of human body; the main object being that a man of ordinary intelligence may be able to analyse his own diet and to plan his own menus wisely.

All living things undergo change. Change is the necessary condition of growth.

Human body is a commonwealth of living cells. Life is constant motion and constant change of these invisible cells. Many chemical changes are involved in these processes. The rate of change varies in the different organs and tissues according to age, activity and sex. Thus the rate of growth from infancy to youth is enormous. The liver and other digestive glands are in a chronic state of rapid change, being involved in the chemical processes of assimilating the

foodstuff. The muscles of the body also undergo rapid change. Every human being gives off a large amount of water containing waste products. Urea in solution is daily excreted by the kidneys and other waste products are discharged in the form of faeces. The chemical change involved in this process of growth and repair of the human body go on day and night. Externally a man walks, talks, bathes, lifts his hands, runs, does exercise, thus there is a great expenditure of energy. If no food is taken for a time the chemical changes will still go on; the tissues of the body being drawn on by the blood for its nutritive material, with the result that, the emaciation sets in and death ensues from starvation. The question therefore arises as to what is the best means of supplying the materials necessary for the growth and repair of the tissues. This involves the study of food and feedings.

What is food?

Food may be defined as anything which when taken into the body is able either to build up or repair the tissues of the body or to supply the material for the production of

heat and muscular work or to regulate body processes. The true food must either be a tissue builder or a source of energy.

Foods are complex substances.

Plant life conserves the energy obtained from the sun in the form of various products and food product is used by animal life therefrom. This is the evident essence of Gayatri-Mantra. All foods are chemically complex substances. They are broken up by the digestive processes into simple elements capable of being absorbed by the blood and tissues. These simple elements are in turn, abstracted from the blood by the tissues, each tissue taking from the blood the particular element which it requires. At the same time, the waste products from the tissues, pass into blood stream and are excreted by the kidney.

Constituents of food.

All foods contain the following nutritive constituents in different proportions. They are called chief nutritive elements of food and are five in number.

1. Proteins.
2. Fats.

3. Carbohydrates.
4. Mineral salts, and
5. Vitamins.

Each food stuff has a particular value in nutrition. The building material of the body is supplied by the proteins, mineral salts and water. They are spoken of as tissue builders. The fats and carbohydrates supply heat and energy while vitamins and mineral salts serve as protective foods and regulators of the body processes.

Proteins-four divisions thereof.

Protein is a term applied to the nitrogenous element in the food. There are various varieties of this substance in meat, eggs and milk of the animal kingdom, and in beans and peas of the vegetable kingdom. Analysis shows that protein is a complex molecule consisting of a number of amino-acids. There are about 18 or more such amino-acids that can be obtained from proteins. Different proteins differ in their composition as to their presence, number and arrangements of these amino-acids and so it is possible that they may have different nutritive

values. It is not possible to determine this qualitative difference in the nutritive values of different proteins by chemical means because it is not possible to completely analyse the complex molecule by chemical means. So the only way to determine the nutritive values of proteins is by biological process i.e. by conducting feeding experiments. It has been shown that whereas the proteins of some foods are very nutritive there are some which cannot nourish well or at all by themselves but can be made nourishing by supplimenting them with some other proteins. So in the terms of such nutritive values, food proteins can be classified biologically as follows :—

1. Complete proteins,
2. Proteins of high biological values,
3. Incomplete proteins and
4. Inferior proteins.

Those proteins which contain all the amino-acids necessary for the growth and well-being of animals are considered complete proteins. Among these complete proteins those which have their constituent amino-acids in such

optimum proportions as to be effectively transformed into body proteins so that most of the proteins consumed as food can be utilised for nourishment, are called proteins of high biological value. The other proteins which lack in one or more of the important constituent amino-acids and thus are incapable of satisfactory nutrition without being supplemented by other proteins are called incomplete proteins. Among these incomplete ones those which are lacking in most essential amino-acids, so that they cannot serve any nourishing purpose even in conjunction with other proteins, are termed inferior proteins.

Main factors of protein.

A few amino-acids Lysine, Tryosine, Tryptophane, Cystine, Histidine, and Proline are the limiting factors of protein and food proteins which are to serve as satisfactory nutrient must include all of them in proper proportions. If proteins of one food stuff lack in some of them or do not contain them in adequate proportion, they may be made satisfactorily nutritive by adding or supplementing them with other proteins which provide

the deficient constituents and make up the deficiency. From the results of experiments on animals and also by observations of different dietary habits of different people, it is believed that animal foods supply proteins which are complete and of high biological value. i.e. they are better nutritive than most of the cereal foods and a mixed dietary of a properly selected combination of animal and cereal diet excels either taken singly or as a combination of different foods of the same class. It is not the quantity but the quality of proteins which plays an important part in the nourishment. The use of foods supplying proteins of high biological value is most desirable. Proteins which are not of such value have to be taken more in quantity rather in excess of what is necessary and a part of excess that is not utilised by the body, will be metabolically excreted out through the kidney in urine as waste.

Fats and their functions.

Fats include fatty foods derived either from animals in form of cream, butter, fat etc. or from vegetables as oils. The edible

fats are composed of stearine, palmitin and olein. The chief function of the fat is :—

1. To prevent waste of tissues.
2. To form a reserve store in the body.
3. To generate heat.

Its excessive consumption in the food invariably leads to the accumulation of fats in the body. The amount of fat required is dependent upon the muscular exercise and the external temperature. In cold countries more fat is consumed than in warmer ones. If sufficient amount of fat is not taken; heat production takes place mainly at the expense of albuminous tissues with the result that the muscles waste soon and the loss of weight takes place.

Carbohydrates.

The speciality of carbohydrates in nutrition is to act as a source of heat and energy. Carbohydrates are the starches and sugar as well as cellulose. Most of the cellulose is not digested but is essential in diet to furnish the bulk as well as for the daily evacuation of the bowels. Chemically, the carbohydrates are composed of oxygen, carbon and

hydrogen. Oxygen and hydrogen are combined to form water. So we can think of carbohydrates as being composed of water and carbon. The name carbohydrates (water) is based on this fact. Different proportions of water and carbon if combined, make different kinds of sugars and different kinds of fruit acids. The fruit acids are also partly carbohydrates. They are supplied almost exclusively by the vegetable kingdom i. e. grains, vegetables and fruits. Carbohydrates are the cheapest source of energy and are always found to be the bases of economical diet. Three fifths of our food for energy and heat is supplied by the carbohydrates.

Mineral salts.

Like proteins, some metallic and non-metallic inorganic elements known as mineral constituents of a diet are quite indispensable for normal growth, health and well-being.

Some well recognised elements of mineral dietary.

Though the importance of such mineral constituents in a diet were recognised by dieticians since long, there was no definite

understanding of the specific pathological conditions that may arise as a result of inadequate mineral supply of the diet and also of the effects of one element on the other. It was believed then that a well assorted diet should contain sufficient mineral matter to meet the needs. It is only during the last decade or so that considerable light has been thrown on such specific problems of mineral nutrition. Calcium, phosphorous, sodium, potassium, iron and iodine are some of the well recognised elements of a mineral dietary.

Precautions necessary to meet mineral requirements.

Sodium and potassium salts are found in abundant quantities in an average diet. The chief sources of potassium are the vegetables fruits and milk in which it is found in large quantities. Sodium is obtained from added salt (Sodium Chloride). Calcium, phosphorous, iron and iodine are found in so varying proportions in common dietaries and their needs are so delicate that proper precautions must be taken to keep the diet well balanced to meet these mineral requirements in optimum proportions.

The need of calcium in a diet.

Calcium and phosphorous are two very important elements of the human skeleton and they are also found in blood. On the average bones consist of calcium carbonate with twice as much of calcium phosphates. Even normally the blood of young persons contains about 10 to 11 mgms of calcium and 5·6 mgms of phosphorous in 100 cc. of the Serum. The total requirement of calcium for the adult is about 0·6 to 0·7 grm per day but more is necessary for growing children and pregnant or nursing mother. At least a daily intake of 1 grm of calcium is necessary for the growth of bones, teeth etc. in growing children. More calcium is required for pregnant or nursing mother since during pregnancy much calcium will be used up by the developing fetus. During the nursing period, this drainage of calcium through lactation will be still more. Normal human milk contains on an average 32·6 mgms. calcium per 100 cc. of breast milk. Milk of cows is much richer in calcium, say about 5 times as much. However absorption and retention of calcium in a child is greater on

breast milk than on cow's milk or its modifications. The presence of calcium in a diet does not necessarily warrant its absorption and utility. It depends on the activity of the parathyroid gland and the presence of vitamin D.

Phosphorous in diet.

The importance of phosphorous is evident from the fact that the human skeleton contains a great deal of this element as calcium phosphate. It is exceedingly useful in the general metabolism as well as in the avoidance of certain deficiency diseases such as rickets. It is found in the constitution of many of the body proteins as well as in the lipoids. It takes part in energy metabolism from glycogem to lactic acid in muscular action and forms part of the lecithins which are the chief means of transport of the fats in the body.

Iron in the diet.

Iron in the diet of normal nutrition, plays a very important part. Though the quantity of daily requirement of iron is very small, say about 11 to 15 mgms per day, failure to

supply this amount to the system may lead to nutritional anemia. It should be remembered here that the average life of the red-cell of human blood corpuscles, is 30 days and 3 to 5 per cent of the red blood corpuscles are destroyed daily. If the body does not produce new red cells as fast as they disappear which means that they should be reproduced at the rate of more than 5 millions per second the blood may be impoverished. Such a state arises when the food is deficient in the substances which are necessary for the formation of either the stroma or the hemoglobin of which the corpuscles are principally composed. Though for many years iron has been administered as a remedy for anaemia with gratifying results, the researches of Heart, Steenbock and others in 1928, show that for making pure iron salts assimilable to the system for building hemoglobin, presence of traces of copper is necessary. It is interesting to note that Mallory (1929) reports that copper in any form is easily absorbed and that it injures red blood corpuscles and causes hemolysis. This suggests that the care and discrimination should be used in

using copper salts for stimulating iron assimilation. Experiments of Titus Cave and Hugues (1928) have brought forward the evidence that manganese is also an essential element in mammalian nutrition and that it is associated with iron assimilation. The principal sources of iron in the diet are Egg yoke, Beef, Spinach, and other green vegetables and some fruits as peaches, apples, prunes etc. Milk is, however, very poor in this element. This is an important point to be remembered in planning certain Menus consisting largely of milk. It may be mentioned here, that at times cases arise where even though the diet is rich in iron, there is meagre regeneration of blood and perniciously anaemic condition soon arises. The improvement of blood in such cases, is brought about by administering specific preparations from liver.

Iodine in the diet.

Coming now to iodine and its significance in the diet, it looks so remarkably curious that though it is needed in very minute quantity, the requirement being some what in the region of say 1/200th of a milligram

per day, it works as one of the keys that govern both growth and intelligence, it being closely connected with the activity of the thyroid gland. The thyroid gland has a capacity to synthesise from iodine a harmone substance called thyroxine and this harmone has a great influence on fat metabolism and also to a certain extent on calcium metabolism. To function normally the thyroid must contain iodine within certain limits. A lack of iodine in the diet, prevents the formation of the hermone thyroxine and leads to hyperplasia and enlargement of the thyroid gland, known as goitre.

Vitamins in the diet.

Vitamins are certain live elements in food. Their chemical compesition has not yet been determined. Their presence in the diet is necessary for growth, reproduction, proper functioning and maintenance of health. Dr. Sherman calls them ignition sparks. The term Vitamin was originated by Funk, an English Scientist, about the year 1912. He was investigating the problem of beri–beri, a deficiency disease caused by a diet of polished rice, or grains of similar

food properties. In the year 1912, in Germany, similar observations were made by Stepp who concluded like Hopkins and Luin that something more was necessary for life than the amounts of pure carbohydrates, proteins and fats to satisfy human bodily requirement of energy and of material for new growth and the replacement of waste tissues.

The theory of missing elements in food.

Many scientists of England and America attempted to isolate and analyse the chemical constituents of the missing food essential in the rice germ and bran. They were not successful in determining the chemical composition of this mysterious substance, but they learnt many of its properties. They conceived the theory that vitamins were specific substances in food and their absence would cause specific diseases. The expectations of these investigators were that scurvy, pallegra, rickets, and perhaps other diseases, known to be caused by a deficient diet, could be cured by the specific vitamin or missing food element, if it could be discovered.

The theory disclosed the dangers of artificial denatured and deficient diet.

The theory that each food deficiency disease has its peculiar preventive vitamin, has just been established by later investigators. But the Vitamin idea has proved of great importance in the stimulation of scientific research. Moreover, the publication of many scientific researches on the subject turned the public attention and imagination towards the broad and general problem of dangers of an artificial denatured and deficient diet.

Discovery of Mc. Collum & Davis–the American Scientists.

These scientists undertook exhaustive feeding tests on rats and pigeons. These tests have resulted in materially furthering the world's knowledge of scientific nutrition.

1. The rats would not thrive on purified food stufls though they included sufficient amount of protein, carbohydrates and fats of vegetable origin. Normal health and growth were secured when a small amount of milk or butter was added to the purified food stuffs.

2. All fats were not of equal dietetic value. Margarine, lard and other vegetable oils, failed to support health and growth of rats. The fats of animal origin such as obtained from milk, eggyolk and suet, were found superior to the fats from vegetable oils.

3. No single grain or combination of grains was sufficient to sustain normal growth in young rats. No warm blooded animal in experimental laboratory, derived complete nutrition from seeds alone. Nature has it that even seed eating birds add insects, green leaves, sprouts and minerals in the form of grit to their diet.

4. The superiority of the whole wheat bread to the white flour bread is distinct. Pigeons fed on white flour bread diet, died more quickly than those kept on absolute fast. White flour is not a poison but it is deficient in many food essentials. The white pigeons died more quickly because the white flour bread added more burden on the digestive tract for breaking down the food stuff. The fasting birds lived longer because they had not to expend their energy, for, digestion but lived on surplus store of fat in them.

5. Even whole wheat bread is not a complete food. Like other grains wheat has an insufficient quantity of fat soluble vitamin and is also deficient in mineral salts particularly of calcium. Both those defects are remedied by the addition of sufficient milk to the diet as milk contains sufficient quantity of calcium as well as both kinds of vitamins.

6. The addition of edible leaves to a diet of meat or grains or mixed diet greatly increases the growth and sustaining power. Mc. Collum calls milk and green leaves as protective foods. He pointed out the remarkable fact that these highly important discoveries in food science, were utterly ignored by mere chemical considerations of foods as carbohydrates, proteins and fats. According to Mc. Collum milk certainly deserves a distinct place as food of the highest order, while vegetables, grains and meat come next.

Individual consideration of each of the vitamins.

By this time the existence of the following six vitamins have been widely known:—

1. Vitamin A. growth promoting and anti-infective.

2. Vitamin B. antineuritic and growth promoting.
3. Vitamin C. antiscorbutic.
4. Vitamin D. antirachitic.
5. Vitamin E. antisterility.
6. Vitamin G. antipellegra.

Attempts on chemical lines to isolate and prepare these vitamins as chemically pure substances show very promising results and we may hope that there will be a time when we shall know them by their chemical names. At present two are already available in more or less chemically pure forms. They are Vitamin C ascorbutic acid and Vitamin D, Irradiated ergoserol.

Vitamin A.

This is present in milk, cream butter, suet, eggs, meat, glandular organs–such as liver, kidney etc., and are specially rich in Vitamin A. Fishes specially those containing a high proportion of fat, codliver and Halibut Oils and green vegetables and fruits are useful sources of Vitamin A. Though this Vitamin is fairly stable to heat, it is destroyed by long boiling i. e. half an hour's boiling

will destroy it. Frying at high temperature of the boiling fats also destroys it. Its presence is necessary for general growth and health. Its absence or insufficient presence lowers vitality and vigour of the body and leads to various characteristic infection, due to increased susceptibility to diseases.

Vitamin B.

Whole wheat and other cereals and legume seeds, unpolished rice, eggs, liver, potatoes, green vegetables, tomatoes, and yeast are useful sources of Vitamin B. Prolonged heat destroys it. It is necessary for growth and well-being. Its absence leads to Beri-beri and other nervous diseases with loss of appetite.

Vitamin C.

The chief sources of Vitamin C are citrous fruits, oranges, lemons, green vegetables and tomatoes, onions, potatoes, and cabbage. Germinated legumes, lentils, peas and beans, when fresh vegetables cannot be had, serve as main sources of vitamin C. It is very susceptible to heat and drying, and so great care should be taken to preserve the antiscorbutic properties of foods.

Vitamin D.

It is present in fats of animals, especially in liver fats of fishes, the chief being cod-liver oil. Milk, Butter, fat and eggs serve as chief natural sources. Solar or artificial ultra violet rays stimulate synthesis of Vitamin D from egosterol and so exposure of dietaries rich in ergosterol enhances the vitamin D value of such foods. Also the exposure of the body to the effects of ultra violet rays is found beneficial in rickets and such diseases are due to the deficiency of Vitamin D. It serves a very important factor in the formation of the osseous tissues by influencing calcium and phosphorous diet to be available to its formation and thus prevents rickets. In the absence of adequate intake of Vitamin D. calcium and phosphorous of the diet do not become satisfactorily assimilable in the formation of the bone and thus produce rickets.

Vitamin E.

Most vegetable and seed oils contain Vitamin E but not in very high concentration. Wheat germ and lettuce leaves are very potent sources of Vitamin E. Vitamin E in

association with vitamin A controls the function of reproduction. Absence or inadequate intake of Vitamin E results in damage to the male and female reproductive organs resulting in sterility.

Vitamin G.

Milk, eggs, meat, yeast and tomatoes serve as useful sources of Vitamin G. in the diet. Vitamin G is also known as Vitamin B/2. Its presence in the diet is useful for promoting growth and preventing pallegra. It is more stable to heat than Vitamin B, also called Vitamin B/1.

What is a calorie ?

Technically a calorie is a unit of heat or energy required to raise the temperature of 1 kilogramme of water to 1 degree centigrade or one pound of water to 1 degree Farenheit. It is a unit of measurement adopted by the biochemist to measure heat.

How to determine the heat value of food.

The biochemist is able to determine the amount of heat each food is capable of furnishing by means of "bomb calorie meter." It consists of a heavy steel bomb with a platinum lining and a cover held tightly in

place by means of a strong screw collar. A weighed amount of food substance is placed within the bomb which is then charged with oxygen with a pressure of at least 300 lbs. or more to the sq. inch, closed or immersed in a weighed amount of water. The combustion of the sample of food placed in the bomb is recorded by the thermometer accurately.

Energy expenditure per hour under different activities.

The average Indian weighing 55 kilogramms (121 lbs.) expends the following amount of energy in varying activities:—

1.	Sleeping	55	calories.
2.	Awake	70	„
3.	Sitting	80	„
4.	Standing	90	„
5.	Work light	110	„
6.	Exercise light	135	„
7.	Exercise hard	355	„
8.	Walk slow	160	„
9.	Walk fast	235	„
10.	Running	395	„
11.	Exercise very Severe	470	„

(Dr. H. C. Sherman's Chemistry of food and nutrition.)

The amount of food required.

The amount of food required varies under different conditions. A growing child requires more than an adult. Old people need less than the middle aged. Strong muscular subject engaged in active physical work, requires more than thin and weakly people leading a sedantry life. Man needs more food than woman and boys more than girls. A woman requires more food during pregnancy and lactation periods. A healthy moderate worker of average weight excrets 16 to 20 gramms of nitrogen and 320 gramms of carbon every day. The extensive investigations of Voit, Rubner and Alwater established the standard amounts of nutritive constituents to make up the above loss caused daily as follows:

		gramms.	calories.
@ 1gm=4 cal.	Protein	125	500
@ „ „	Carbohydrates	500	2,000
@ 1gm=9 „	Fats	90	810
	Total.		3,310

This is the standard requirement for men doing moderate work in the western countries. In case of men doing hard muscular work, the amount of food required is greater than the above and the energy value of food would be from 4,500 to 5,000 calories.

The protein requirement of human body.

Protein is one of the body building materials. In dietaries nitrogen has a place and importance of its own. We must daily take in a certain minimum quantity of the element but opinions differ as to the exact amount of the minimum. The following table will show that the protein standard differs in different countries:—

Details of standard requirement.	Grams of protein per men per day.	Calories from all sources.
For men at moderate work in West At Water:	125	3,500
For hard work.	150	4,500
British War ration.	175	4,855
Average men (Royal Society War Food Committee.)	100	3,390

Details of standard requirement.	Grams of protein per men per day.	Calories from all sources.
Fourteen families in York (wages under 26s. Rowntree.)	89	2,685
Twelve labourers' families in New York Wilson.	101	2,905
For light work in Japan (Oshima).	100	3,000
20 middle class families in Shantung (Adolph).	111	3,355
For hard work Jinriksha men (Oshima).	158	5,050
Artisan family Bengal.	40	2,283
Prison diet (Mc. Cay).	93	3,500
Standard Military Ration Mrs. Armstrong.	86	2,400
Muscular Agriculture work U. P-	100	2,400

Dr. Chittenden on protein requirements of the classes of people.

Proteins are heat & energy giving to the body and hence the people of the cold climate consume more food containing proteins than those in the tropics. The researches of Dr. Chittenden on protein requirements has

thrown more light on the subject and has attracted the attention of the scientific world. Dr. Chittenden took three classes of men (1) doing mental work, (2) Soldiers in moderate exercise, (3) Highly skilled Athletes. He found that a state of good bodily health was maintained on a diet which contained from one half to one third of the protein in Standard diet. According to Dr. Chittenden the ideal diet consists of the smallest amount of protein food together with non-nitrogenous food. This will keep body in a state of perfect health and vigour.

Chittenden's Standard.

(a) The commonly accepted minimum standard of protein requirement is from 100 to 125. Dr. Chittenden after his observations concluded that the amount of protein required daily to maintain the body in a perfect state of health is less than the amount hitherto considered as assential. (b) that some of the excess is injurious to health.

Dr. Hindhede's Standard.

(b) Dr. Hindhede the Director of Nutritional Research Institute at Copenhagen, Denmark,

remarks that enormous strain is caused by the unnecessary high protein diet on kidney. One half of the standard amount of nitrogenous food is quite enough to keep the body in a perfect introgenous equilibrium.

Dr. Chittenden's minimum standard of protein requirement is therefore 50 to 70 grams per day. The excess over works the kidney deposits protein metabolism in tissues and surcharges the blood, which gives rise to various diseased states.

Dr. Sherman's warning.

During the great war it was estimated that the population was over eating to 59·7 per cent calories and 44 per cent of protein. When rations at all fronts, were to be restricted the suggestions were carried out in practice as shown by physiologists. The German army rations were also curtailed yet the offensive and resisting power of German Soldiers were not affected thereby. Dr. Sherman however in his "Food and Nutrition" warns us that the difference between the amount actually required and the amount which would ordinarily be allowed in planning a dietary, is much greater with protein

than with fuel value. The surplus protein is a factor of safety and it is wise to set the standard of protein considerably higher than the actual requirement. This is especially necessary for women and for growing children. Neither is it wise to estimate the protein requirement as constituting a fixed proportion of the total calories since muscular work increases the energy required very greatly.

In planning a dietary for an entire family group, it is however rational to compute the protein allowance as 10 to 15 per cent of the total energy value of the diet.

Sir R. Mc. Carrison on Protein requirement in India.

Sir Robert Mc. Carrison states in his book on food that the diet of the people of India residing in the North should be.

90 to 100 grams	of proteins,	360 to 400 calories
80 to 90 ,,	of fats.	720 to 810 ,,
360 to 450 ,,	of carbohydrates.	1440 to1800 ,,
		2,480 3,010 ,,

In this way we shall be able to secure a total of 2,480 to 3010 calories.

He recommended for people living in the south, southeast and southwest India the following:—

60 to 70 grams	of proteins	240 to 280 calories.
50 to 60 grams	of fats.	450 to 540 calories.
460 to 550 grams	of carbohydrates.	1,790 to 2,090 ,,
		2,480 to 3,010 ,,

the total requirement of calories being made up by adequately increasing the amount of carbohydrates.

Defects in cooking.

(a) Vegetables—Most of the vegetables in India are cooked in oil. Frying destroys mineral as well as vitaminous elements. A coating of grease is formed over the food making it extremely difficult for the digestive juices to penetrate and mix with the food. The flavour if properly cooked, is so good that crude salt is unnecessary. It is only because natural salts are missing that we desire to add more salt in the vegetables. Vegetables should be cooked in water and it need not be thrown away if surplus. This water contains many mineral

salts. Especially in Gujerat vegetables are fried in oils. The boiling point of oil is 350 to 450 degrees F. i. e. 5 times as much as water. The more heat in oil, kills the vitamins and destroys the mineral salts with them and the foods so cooked gives extra strain on the digestion as digestive juices cannot penetrate and mix with the fried food. Some people add Soda in cooking vegetables. This too, is a powerful irritant and destroys vitamin. Mineral starvation is one of the greatest troubles of India. Indians suffer from phosphorous calcium and iron deficiencies. Too much of chillies spices and condiments irritate the muccous membranes of stomach, and intestines. Burning acidity, piles and fistula, are the results of too much spices and condiments in vegetable cooking and cooking of other dishes.

The white flour Scare.

Indian people consume much white flour in their sweet meat preparations. All the bran and the germ are removed from wheat. There is a deficiency of vitamin A and D in the white flour and also of the mineral salts of calcium, iron and manganese. Indian

people should avoid excessive use of white flour.

Ghee Sugar and rice if in excess.

People of higher class consume more ghee and sugar which have no body building properties in them. Obesity, Rheumatism Gout and flatulence are very common among the rich. Mill-polished Rice are eaten in high class families. There is a deficiency of proteins and vitamins in this rice. People suffer from pallegra, scurvy, and beri-beri where polished rice forms the staple article of diet.

A Common defect of Cooking rice.

Most people boil rice and throw away the water, as they do with vegetable cooking. Vitamin and mineral salts are lost in such waters thrown away.

Other general defects in Indian home cooking and diets.

Most of the cooking in Indian homes is done uncovered. Most of the aroma, alkaloids and vitamins are evaporated. Food is exposed ed to dirt, flies and vermin and is often prepared in untinned vessels. It is sometimes undercooked or overcooked. At big festivities

food is prepared in big unclean nontinned vessels. Sometimes the surplus food of the morning is recooked in the evening, with addition of oil, chillies, salt and spices. This destroys all the nutritive elements of food. Dal and vegetables of the morning or left overnight and stale are eaten with chapati or rice. This is dangerous at times when epidemics are raging. Stale sweetmeats sold in Indian Bazar should be avoided.

Everything for the palate and nothing for nutrition.

Adding of too much oil, chillies, spices, in food stuff is very common so much so that everything is done for the palate and nothing is left for nutrition.

CHAPTER XVI.

European and American Soya Bean Recipes.

Table of weights used.

8 Drams–1 oz.
16 Ozs.–1 lb.
1 Pinch–$\frac{1}{8}$ oz.

Indian equivalents.

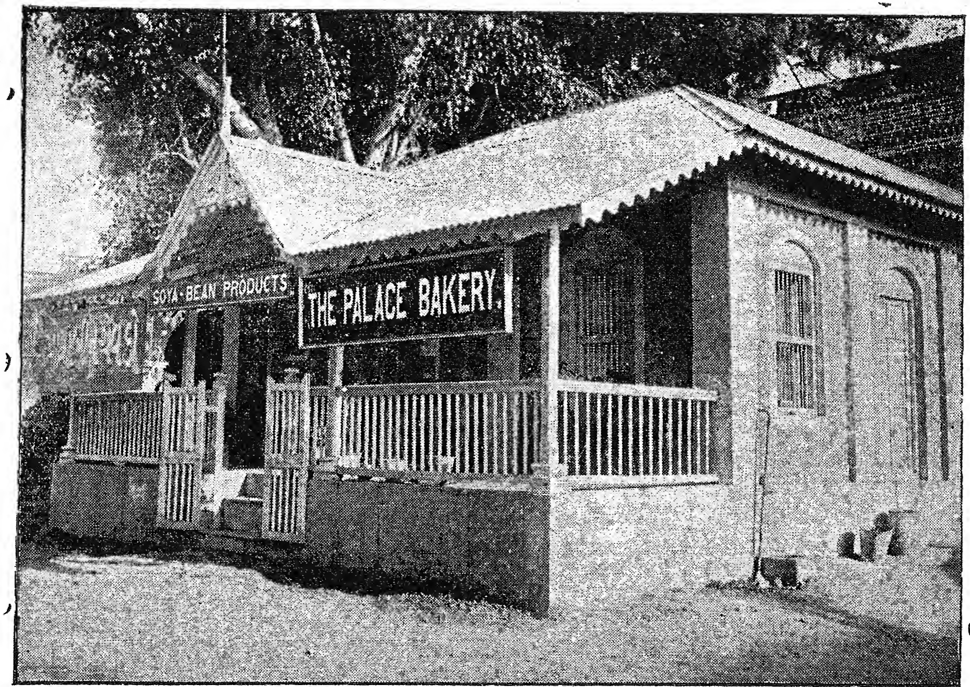
1 oz.–$2\frac{1}{2}$ Rupee weight.
$2\frac{1}{2}$ Tolas.
1 lb.–1 Seer Kaccha.
40 Rs. Weight.
40 Tolas.

Liquids.

1 Salt spoonful–$\frac{1}{4}$ oz.
1 Tea–spoonful–$\frac{1}{2}$ oz.
1 Table–spoonful–1 oz.
1 Breakfast cupful–4 ozs.

How to prepare soya bean sprouts.

The method of sprouting soya bean is little different from those of mung bean, udad, cholum, Val, Math, peas, and other



The first soya bean Bakery in India.

legumes. Take an earthen jar and make small holes at the bottom to drain water. Place some kind of cloth inside the jar at the bottom to prevent beans running out of the holes. Flood the beans with water 4 to 5 times a day. Wash the beans thoroughly and put them in the jar. In winter warm water should be used. In hot season cold water will do. In China an earthen jar 3 feet high and a diameter of half the height is used. The Chinese use bamboo mat to prevent the sprouts going out instead of cloth. The beans require 3 to 5 days for sprouting in summer and 10 to 12 days in winter. It being warm a little less time is required for sprouting. At the end of that time the sprouts grow from 1 to 2 inches in length. In China many families earn their living by making sprouts and selling them in the market. A variety of dishes can be made from sprouts. They are used in Salads, Omelettes, Stews etc., In winter when the vegetable are scarce and dear, it is extensively used instead. It is eaten raw as well as cooked. It is the chief source of Vitamins A and C which are found in fresh fruits and vegetable.

Method.

Unskin the soya sprouts. Clean them with warm water. Strain and dry. Place in Salad bowl. Put 1 tea spoonful salt, ½ teaspoonful of pepper and a little vinegar over it. Stir until the salt is dissolved. Add 2 teaspoonfuls of salad oil. Mix the salad thoroughly. Place on the top soft Parsley and serve cold.

(2) Salad a la Italianne.

Materials.		Lb.	Oz.	P.
Cooked carrots	...	0	1	0
,, turnips	...	0	1	0
,, potatoes	...	0	1	0
,, Beetroots	...	0	1	0
Soya sprouts	...	½	0	0
Salt				
Pepper				
Lemonjuice				
Vinegar				

Method.

As above. Cut carrots etc. in small pieces. Mix all well together. Decorate with tomatoes and other vegetables and serve with tartare sauce.

(3) Salad a la Japonaise.

Materials.	Lb.	Oz.	P.	other measures.
Truffles coarsely chopped.				one.
Cool boiled potatoes cut into discs.				two.
Sprouts ...	½	0	0	
Blanched onion finely chopped.				One.
Parsley finely chopped.				One.
Anchovy.				two small fillets.
Salad oil.				1 teaspoonfuls.
Salt.				1 teaspoonful.
Pepper.				½ ,,
Nutmeg	0	0	1	

Method.

Mix the truffle, potatoes, spices together. Add salad oil. Add onion, parsley. Serve garnished with lettuce leaves and fillet of Anchovy.

(4) Green soya bean salad.

Materials.	Lb.	Oz.	P.	other measures.
Cooked soya bean.	½	0	0	
,, Beet root.				One.
Hard boiled egg.				One.
Parsley fine chopped.				½ teaspoonful.
Garlic.				One clove.

Method.

Boil the green beans in slightly salted water. Drain well. When cool cut the clove of garlic and pieces and rub inside the salad bowl with the cut side. Mix the cooked green peas with one salad tea spoonful dressing and seasoning of salt and pepper. Garnish with rings of hard boiled eggs, slices of beet root. Sprinkle the parsley over and serve.

Soya bean sprout salad a la Americaine.

Materials.	Lb.	Oz.	P.	other measures.
Soya sprouts ...	½	0	0	
Small cabbage trimmed washed and finely shredded.	0	1	0	
Butter ...	0	1	0	
Vinegar.				1 teaspoonful.
Sugar.				,,
Salt.				,,
Pepper.				to taste.
Sour cream.				¼ pint.

Method.

Bring butter, vinegar, salt, pepper to boiling point. Pour it over sprouts and cabbage. When quite cold stir in the cream and serve.

Soya sprouts salad a la Indienne.

Materials.	Lb.	Oz.	P.	other measure.
Soya sprouts ...	½	0	0	
Onion sliced.				One.
Salad oil.				2 tea spoonful.
Salt.				1 tea spoonful.
Pepper.				½ ,, ,,
Lemon juice				q. s.
Vinegar.				q. s.

French sprouts.

Prepare a sauce as for carrot or for any other vegetable. Cleanse the sprouts and add to the sauce. Simmer in double boiler for five minutes and serve.

French sprouts salad.

Cleanse one lb. of sprouts and put in a cold water to chill. When thoroughly drained, sprinkle with a little salt and pour over them a French dressing made as follows: Rub a sout plate with clove or garlic, or cut an onion. Put in a half level teaspoon of salt, one-eighth teaspoon of paprika and then add one tablespoon of olive oil, stirring briskly until the salt is dissolved; then add two tablespoons of vinegar stirring constantly.

Spanish salad.

Prepare one lb. of sprout as for French sprouts salad. Add one small Spanish onion finely chopped one cup off chopped off celery and add one sweet pepper minced very fine or one pimento. Stir all together with mayonnaise dressing which will require plenty of salt in it, or salt a little vegetable at first. Leave a little mayonnaise to spread on top. Garnish and serve.

Potato salad.

A few bean sprouts added to a potato salad will be found a delicious and appetizing addition.

Sardine salad.

Parboil one stalk of celery and one small onion together in one pt. of water. When cooked thoroughly, drain and mash into one small box of sardines first draining off the oil prepare some sprouts with a French dressing and serve on lettuce leaves.

Fruit salad.

A delicious fruit salad is made by taking equal parts of bean curd (first cut into dice) orange, pineapple, and a few nut meats

added. Make a nest bean sprouts and pour over the whole a French dressing and serve.

Chicken salad.

Prepare a chicken salad in the usual way. Add one cup of diced bean curd and one of bean sprouts. This will be found a decided improvement.

Fish salad.

Take one cup of any kind of left over fish to 1 lb. of bean curd and with salt and pepper to taste, mash together (a little finely minced parsley or onion may also be added).

Soy chicken salad.

Cut the soy cake (tofu) in thin, narrow strips put into cold chicken stock and heat from 20 to 30 minutes. Allow the soy cake to remain in the stock until cool in order to absorb flavor. Then remove and use in salad as shredded chicken, with a little real chicken added.

Soy cake (tofu) salad dressing.

Mash the soy cake with a fork and mix with oil and vinegar dressing, mayonnaise, or any other desired salad dressing. Allow to stand 30 minutes before using Mayonnaise

can be made to go farther at less cost if mixed with soy cake.

Soybean salad.

1 cup chopped boiled soyabeans.
1 cup celery chopped fine.
½ cup American cheese.

Combine and serve on crisp lettuce; garnish with celery.

Soybean and cottage cheese salad.

1 cup cooked soybeans.
1 cup cottage cheese.

Put the beans through the food chopper and season well with salt and pepper. Combine with cottage cheese. Serve on crisp lettuce leaves and garnish with strips of pimento.

Soya bean soup.

1 cup dry soybeans.
1½ cups canned tomatoes.
1 teaspoon salt.
Paprika, pepper, water.
1 teaspoon chopped onion.
½ teaspoon butter.
1 tablespoon substitute flour.

Soak beans in cold water 12 hours. Boil beans in water 4 hours, replenishing water as it boils away. Mash the boiled beans and put through a sieve. Saute the onion, add flour and blend. Add water and tomatoes, and other ingredients.

Soya Bean vegetable soup.

2 cups boiled soybeans.
2 cups strained tomato pulp.
2 cups water.
½ cup chopped celery.
2 teaspoon onion juice.
¼ teaspoon pepper.
1 teaspoon salt.
1 tablespoon cornstarch.

Cook the celery in the water until tender. Mix the cornstarch and seasoning with the cold tomato and add with the bean pulp to the celery and water. Cook 20 minutes.

Cream of soybean soup.

2 cups boiled soyabeans.
1 qt. skin milk.
½ teaspoon salt.
¼ teaspoon pepper.
1 tablespoon cornstarch.

SOYA BEAN.

Press the cooked beans through a colander. Mix the cornstarch with one-half cup cold milk. Heat the remainder of the milk in a double boiler with the soybeans, salt and pepper. Add the cornstarch mixed with milk and cook for 20 minutes.

VEGETARIAN DISHES.

Vegetable roast.

Ingredients;—

$\frac{1}{2}$ lb. lentils, 2 onions, $\frac{1}{2}$ lb. mashed potatoes, 1 tea-spoonful chopped parsley, 2 tomatoes, $\frac{1}{2}$ cup brown crumbs, 2 oz. soya flour, about 1 pint good stock seasoning.

Method:—

Soak lantils overnight in the stock, strain off the liquid and boil it. Add, lentils, onions, tomatoes and cook slowly for an hour. Rub through a seive and add soya flour bread-crumbs, potatoes, parsley and seasoning. Form into a roll, place in a greesed roasting pan cover with greased paper and bake about 40 minutes.

NOTE:—This mixture can be made into patties and fried, or put into a greased cake tin, and baked.

Tomato dumplings:—

Ingredients:—

6 small tomatoes, 2 table-spoonful bread-crumbs, ½ tea-spoonful chopped parsley, 1 table-spoonful chopped ham, salt and pepper.

Method:—

Cut off the stem end of the tomatoes, mix the dry ingredients together and bind with pulp scooped out from the tomatoes. Fill each cavity with this mixture. Cut six rounds of flaky pastry and lay a tomato on each, wet the edges and gather together over the tomato. Bake on a greased tin for ½ an hour.

Dried soya beans.

The mature or dry soybeans can be used in many palatable ways. The ordinary varieties of soybeans as the Mammoth, Midwest, Ito San etc., require a longer period of soaking and cooking than navy beans. The Easy-cook and Hahto varieties need no more preparation than the ordinary bean as they cook up very readily. Time may be saved by using a pressure cooker for they soften very readily when thus treated. In general it is well to soak the beans and then cook them until

soft. The time required will vary with the dryness of the bean and also with the variety. After soaking to 20 to 24 hours the beans should be cooked until they are well softened which may require as much as 2 hours, or more. Better results are obtained if the beans are allowed to simmer rather than boil rapidly.

Boiled soybeans.

Soak 2 cups dried soya beans for about 12 hours. Drain, then add water, one-quarter tea-spoonful soda, and cook just below the boiling point for 2 hours or until the beans are slightly softened. If allowed to heat too rapidly, the beans tend to become hard. The double boiler is good for cooking as slow cooking is desirable. The fireless cooker may also be used advantageously; boil the soaked beans for one-half hour and finish cooking in the fireless cooker. A pressure cooker, which is used for canning or other purposes, will save time in cooking soybeans for they soften very readily when cooked under pressure. When cooked thus, fill a quart jar with soaked beans, add 1 tea-spoonful salt and half fill the jar with cold water. Cook one hour and a half at 15 lb. pressure.

Baked soya beans.

2 cups boiled soya beans.
1 cup strained tomato pulp.
1 tablespoon cornstarch.
$\frac{1}{4}$ tea-spoon celery seed.
Dash of paprica.
$\frac{1}{4}$ tea-spoon salt onion juice.
$1\frac{1}{2}$ teaspoons salt.

Take a tomato sauce by mixing the corn-starch, celery seed, paprica and onion juice with cold tomato pulp and cook until it thickens. Pour over the soya beans and bake in moderate oven until brown.

Baked soya beans with ham.

$\frac{1}{4}$ lb. of salt pork.
1 tea-spoon of mustard.

Soak the beans over night in cold water. Pour off the water, and put beans in pot. Cover with cold water, add the soda and cook gently until the beans are slightly softened. Pour off the water, mix the molasses and mustard with a pint of water and pour this over the beans, add more water if the beans are not covered. Place the pork upon

the beans, cover the vessel, and bring it to a boil. Then put in a fireless cooker and leave for 10 or 12 hours.

Soya bean meat.

Ingredients.

One and one-third cupful soya beans, $\frac{1}{4}$ cupful pea-nut butter, $\frac{1}{2}$ cupful cold water, 2 level tea-spoonfuls salt, 1 level tablespoonful cornflour.

Method.

Soak the beans overnight. In the morning drain off all the water. Grind the beans through a food mincer, using the nut butter disk. Mix the remaining ingredients with the beans. Steam or boil in a double cooker for three hours. This may be sliced, grilled, and served with jelly, gravy, or sauce, or baked in tomato juice.

Soya bean loaf.

Ingredients.

Two cupfuls soya beans, 3 tea-spoonfuls salt, 1 cupflul strained tomato, 2 bay leaves, 1 onion, $\frac{1}{2}$ teaspoonful thyme, 1 tea-spoonful sugar, 1 table-spoonful butter or substitute.

Method.

Soak the beans overnight. In the morning drain the beans and grind them through a food mincer, using the nut butter disk. Put the strained tomato, bay leaf, sliced onion, and thyme into a sauce-pan and boil till reduced one-half. Rub through a colander. Add to the ground beans, together with the salt, sugar and butter. Steam or boil in a double cooker for three hours. This may be eaten cold, grilled, or used for sandwich filling.

Soya bean patties.

Ingredients.

One cupful cooked soya bean flour, 1 tea-spoonful salt, 3 cupfuls water.

Method.

Cook in a double boiler for two hours. When cool, slice and roll in crumbs, lay on an boiled pan, brush on top with butter, and bake in the oven till lightly brown.

Soya bean croquettes.

Ingredients.

One cupful cooked soya bean mixture (as above), 1 cupful cooked rice, 1 egg, 2

table-spoonful chopped nuts or olives, 1 tea-spoonful salt.

Method.

Shape into croquettes, roll in egg and fiour, bake in oven.

Soya bean croquettes.

2 cups boiled beans.
1 egg.
1 tea-spoon salt.
¼ tea-spoon pepper.
2 oz. chease.
½ cup ground celery top and all

Method.

Grind the soya beans, cheese and celery through a meat grinder. Add the salt, pepper and one-half the egg, saving the remainder to use in crumbing the croquettes. Form into desired shape, roll in egg diluted with one-half table-spoon water, then mix in the corn meal and bake in greased pan until brown.

Soya bean croquettes.

1 cup soya bean pulp.
2 cups cooked rice.
3 table-spoon chopped onion.
1 table-spoon shortening.

1 egg.
½ cup corn milk.
½ tea-spoon salt.
⅛ tea-spoon pepper.
¼ tea-spoon bouquet.
1 tea-spoon paprica.

Method.

Brown onion in shortening. Put one cup cooked soya beans through colander or food chopper. Add cooked rice and seasonings. Mold croquettes, dip slightly beaten egg, then in yellow corn meal. Bake in very hot oven in shallow pans for about 30 minutes (until brown). Serve with tomato sauce.

Preparation of soya bean flour and uses.

Soya bean flour is made either by grinding tne whole bean or the press cake remaining after the oil has been extracted from the bean. Flour is becoming an important article of diet in America and other European countries, on account of its nutritious valve. ¼ soya flour with ¾ wheat flour has been found to be the best proportion. In pastry ½ of soya bean flour can be used. In England soya bean flour can be had under

the name of so called 'soya Flour' which is 25 p. c. soya flour and 75 p. c. Wheat flour. This soya flour is much used in English Bakery. In U. S. A. Soya bean flour is sold in the market. Many dishes such as Biscuits, Muffins, bread can be prepare l out of this. It is used in the Kitchen for:—

1. Thickening for soups.

Wheaten fiour is mixed with an equal proportion of soya flour.

2. Dough.

By mixing 10 to 15 p. c. soya flour with the wheaten flour the addition of eggs is wholly or partly saved, the soya flour imparting at the same time a pleasant yellowish colour to the mixture.

3. Binding for vegetables.

As in the case of soups.

4. Substitute for meat:-

25 to 50 p.c. of soya flour can be added to minced or hashed meat. In this way meat-pies, sausages, pasties, stuffed cabage, tomatoes etc. may be prepared.

5. All kinds of sweetmeats.:-

These can be prepared with an addition of soya flour thereby effecting a considerable

saving in fat, sugar and eggs. The flavour is improved and the nutritive value increased.

SAUCES.

White sauce.

Ingredients.

$\frac{1}{2}$ pint milk, $\frac{1}{2}$ pint stock, 2 oz. margarine, 1 oz. flour, 1 oz. soya flour, carrot, onion, pinch of herbs, salt and pepper.

Method:-

Put milk, vegetables and seasoning into pan. Mix margarine, flour and soya flour into a paste in a basin, and stir into the milk until, boiling. Simmer for 10 minutes and put through a fine strainer.

NOTE:—This sauce can be used for cauliflower au gratin, macaroni chees and all dishes requiring a good creamy sauce.

Brown Sauce.

Ingredients:-

1 pint good stock, 2 oz. margarine, 1 oz. flour, 1 oz. soya flour, carrot, onion, pinch herbs, bacon rind, salt pepper, 2 table spoonfuls tomato sauce.

Method:--

Melt the margarine, fry the chopped carrot and onion, and bacon rind until gold brown, add the flour and soya flour and brown them. Add stock gradually and stir until it boils. Put in the tomato sauce and herbs and simmer for 20 minutes. Season and strain.

Short crust.

Ingredients:--

7 oz. flour, 1 oz. soya flour, 2 oz. margarine, 2 oz. lard, $\frac{1}{2}$ tea-spoonful baking powder, tea-spoonful salt, water to mix.

Method:--

Sifl flour, soya flour, baking powder and salt into a basin. Add the lard and margarine and chop into the flour with a knife. Mix to a paste, not too stiff, with water. Turn on to a lightly floured board, roll out and fold in three and seam the open ends with the rolling pin. Give two more rolls like this, with ten minutes between each. Set in a cool place for sometime, then roll out to the shape required and use.

FISH.

Frying batter.

Ingredients:--

2 oz. flour $\frac{1}{2}$ oz. soya flour, pinch salt, 1 table spoonful oil or melted butter, 4 table-spoonful tepid water, whipped white of anegg.

Mothod:--

Sift flour, soya flour and salt into a basin, make a hole in the centre, add the oil and water, gradually stirring until quite smooth Beat all very well and stand aside for an hour Then add stiffly beaten white just before using.

Note. Use for coating fish, apples, bananas etc.

Stuffing for baked fish.

Ingredients:--

2 oz. suet, 2 oz. bread-crumbs, 2 oz. soya flour, 1 table-spoonful of chopped parsley, good pinch of mixed herbs, salt and pepper. 1 yolk of egg, 2 table-spoonful of milk or more.

Method.

Mix all very well together and use for stuffing haddoc.

NOTE:—This stuffing can also be used for loin or shoulder of lamb or game.

Soya bean biscuits.

½ cup wheat flour 5 tea-spoons baking powder.

¼ cup soya bean flour Salt.

1½ table-spoons fat Milk.

Method.

Mix the dry ingredients and sift twice. Work in shortening with tips of fingers. Add gradually the liquid, mixing with knife to soft dough. It is impossible to state the exact amount of liquid owing to differences in the flour. Put on a floured board and roll lightly to ½ in. thickness. Shape with biscuit cutter. Place on greased pan and bake in hot oven 12 to 15 minutes.

Soya bean Muffins.

Materials.

2 eggs well beaten.

1 cup cold boiled bean pulp.

½ cup milk.

1 tea-spoon salt.

2 cups flour.

2 tea-spoons baking soda.

⅓ cup melted fat.

Method.

Combine the ingredients in the order given. Bake in a greased muffin pan for 20 to 25 minutes. These muffins make a good border for a pot roast, served with brown gravy.

Soya bean muffins.

1¼ cups wheat flour
¼ cup soya bean flour
½ tea-spoon salt
2 eggs
1 cup sweet milk
2 rounded tea-spoons baking powder
1½ table-spoons melted butter

Beat the ingredients well together, adding the melted, but not too hot butter last and bake in gem pans in a hot oven.

NOTE:—Persons desiring a food of low starch content should take in the above recipe 1¼ cups soya bean flour and ¼ cup of wheat flour.

Soya bean Cocoanut Pudding.

3 Table-spons shortening
1 cup brown sugar
½ cup milk

- $\frac{1}{2}$ cup shredded cocoanut (steamed untilmoist)
- $\frac{3}{4}$ cup soya bean flour
- $\frac{1}{4}$ cup wheat flour
- $\frac{1}{4}$ tea-spoon salt
- 3 eggs beaten separately
- $1\frac{1}{2}$ table-spoons baking powder

Method.

Cream the shortening and brown sugar, add egg yolks well beaten, then add alternately the milk and sifted ingredients. Have the cocoanut prepared, and add with the last of the flour. Beat well, then add beaten egg whites, turn into well-boiled spout cake pan and bake in.

Soya bean croquettes (mush).

- 1 cup soya-bean mush
- 1 cup cooked rice
- 1 egg
- 1 tea-spoon grated onion
- 1 tea-spoon salt
- $\frac{1}{4}$ tea-spoon pepper
- 2 table-spoons chopped salt pork

Shape into croquettes, roll in egg and corn meal or flour and bake in oven.

Soya bean loaf (mush)

1 cup chopped meat
1 cup soya bean mush
2 cups mashed potatoes
2 table-spoons chopped onion
1 table-spoon dried celery leaves.
2 tea-spoons salt

Combine the ingredients, bake as a loaf for one-half hour or shape into small cakes and fry in drippings.

Soya bean mush.

1 cup soya bean flour
1 tea-spoon salt
3 Cups water

Cook in a covered double boiler for 2 hours. When cold it can be sliced, rolled in corn flour and fried in drippings.

Soya bean spice cake.

¼ cup shortening
1 cup brown sugar
2 cup molasses
3 eggs beaten separately
¾ cup soya bean flour
1½ cups wheat flour
3½ tea-spoons baking powder

½ tea-spoon salt
1 tea-spoon cinnamon
½ tea-spoon cloves
½ tea-spoon nutmeg
1 cup raisins
½ cup milk

Cream the shortening and sugar, then add molasses, then egg yolks beaten until thick and lemon coloured. Mix and sift the dry ingredients adding them alternately with the milk, stirring the raising in with a part of the flour. Beat well, then add stiffly beaten egg whites and bake in a greased tube cake pan in a moderately slow oven until it shrinks from the sides of the pan.

Soya bean fruit pudding.

1½ cups bean pulp
6 tea-spoon lemon juice
3 tart apples
¼ cup currants or raisins

To the bean pulp add salt to taste, and lemon juice, mixing well. Dice apples and mix with ¼ chopped currants or raisins. Shape pulps into balls dipped into the chopped apples and raisins, covering well. Serve on lettuce leaf with mayonnaise.

Soya bean jam pudding.

½ cup brown sugar
⅓ cup corn syrup
3 beaten eggs
½ cup sour milk
½ teaspoon soda
1½ cups soya bean flour
1½ teaspoons baking powder
⅓ cup finely chopped suet
¾ teaspoon salt
½ teaspoon cinnamon
1 cup strawberry, blackberry or raspberry jam.

Cream the sugar and syrup. Beat together the eggs, soda, and sour milk, add about half to first mixture, then stir in suet; then add alternately the balance of sour milk mixture, sifted dry ingredients and jam. Turn into well boiled pudding dish or spout-cake pan and bake in moderate oven about 40 minutes. Serve hot with pudding sauce or cold as cake.

Wholemeal scones.

Ingredients.

7 oz. wholemeal flour (stone ground) 1 oz. soya flour, 1 oz. margarine or lard,

1 teaspoonful baking powder, pinch salt, about 1 gill milk with 2 tablespoonful warm water in it.

Method.

Sift all dry ingredients into a basin and rub in the fat. Mix to a stiff white dough with the milk. Roll out and cut in rounds or three-cornered shapes. Brush over with milk or egg and bake from 10 to 15 minutes in hot oven.

Sultana scones.

Ingredients.

7 oz. flour, 1 oz. soya flour, 1 oz. margarine or lard, ½ teaspoonful bicarbonate of soda, 1 teaspoonful sugar, pinch salt, 1 teaspoonful cream of tartar, 1 oz. sultanas, 1 gill milk (sour if possible).

Method.

Sieve all the dry ingredients together except bicarbonate of soda. Dissolve it in the milk and mix all to a dough. Turn on to a floured board, divide in two and form into rounds. Cut accross the tops to form each into four three cornered scones. Brush over with milk or egg and bake in a quick oven for 10 to 15 minutes.

Quick oven scones.

Ingredients.

7 oz. flour, 1 oz. soya flour, $\frac{3}{4}$ oz. baking powder, $\frac{1}{2}$ teaspoonful salt, $\frac{1}{2}$ oz. margarine, $\frac{1}{2}$ oz. lard, about 1 gill milk and $\frac{1}{2}$ gill warm water mixed.

Method.

Sift dry ingredients together and rub in the fat with the finger tips. Mix to a rather soft dough, using a knife. Turn on to a well floured board. Roll out $\frac{1}{2}$ an inch thick and cut in small rounds, brush with milk or egg and bake in a quick oven for about ten minutes.

Porridge.

Ingredients.

4 tablespoonful medium oatmeal, $\frac{1}{2}$ tablespoonful soya flour, 1 tablespoonful sugar, and a good pich salt, $\frac{3}{4}$ pint boiling water.

Method.

Mix all the dry ingredients thoroughly together and sprinkle into boiling water, stirring all the time, then let simmer for twenty minutes stirring occasionally.

Baked rice pudding.

Ingredients.

2 tablespoonful rice, 1 oz. soya flour, $1\frac{1}{2}$ oz. sugar, 3 gill milk, 1 gill water, pinch of salt.

Method.

Put rice together with sugar and salt into a piedish, then mix soya flour to a smooth paste, using some of the milk and water to the other ingredients and bake in a slow oven for two hours.

Soya bean omelet.

2 eggs.

2 tablespoons milk..

3 tablespoons soya bean mush.

2 tablespoons cooked rice.

$\frac{1}{4}$ teaspoon salt.

The advantage of this omelet is that a larger and more nutritious omelet is made by the use of soya bean flour and rice.

Soya bean wafers.

$1\frac{1}{4}$ cups wheat flour.

$\frac{3}{4}$ cup soya bean flour.

2 tablespoons vanila.
¼ cup milk.
1 egg.
½ teaspoon salt.
2 tablespoons butter.
2 tablespoons lard.
2 teaspoons baking soda.
1 cup sugar.

Cream butter; add sugar, well beaten egg, milk and vanila. Mix dry ingredients and add to first mixture. Roll as thinly as possible, cut, and bake in a moderate oven.

Soya bean filling for sandwiches.

1 cup soya bean pulp.
1 teaspoon salt.
¼ teaspoon paprika.
1 teaspoon lemon juice.
¼ teaspoon onion juice.
⅙ teaspoon thyme.
Dash of cayenne.

Mix the ingredients together to serve as filling for sandwiches.

Soya bean gems.

1 egg.
1 tablespoon cream.

2 tablespoons soya bean flour.
¼ teaspoon salt.
½ teaspoon baking powder.

Note:—This recipe makes four gems and will be found especially desirable for persons requiring a food of low starch content.

Soya bean pastry.

1 cup flour.
½ cup soya bean pulp.
½ teaspoon salt.
2 tablespoons shortening.
1 teaspoon baking powder.

Moisten with cold water and roll out as ordinary pie crust. Avoid mixing.

Soya bean souffle.

½ cup bean pulp.
½ tablespoon butter substitute.
1 tablespoon flour.
½ teaspoon salt.
1 egg.
½ cup milk.

Melt butter substitute, add flour, and milk. Boil one minute, stirring constantly, add soya bean pulp; cool; add beaten yolk of egg

and seasoning. Beat white of egg until stiff; fold into mixture, and bake 30 minutes.

Mexican frigoles.

Soak 1 pt. of soya beans over night. Boil them for about 4 hours. Melt 2 table spoons of fat in a frying pan; Add the beans; cook them for 10 minutes. Serve with sauce made by the following recipe:

Firgole sauce-Rub together 1 tomato, 5 green chillis (minced) 1 small onion (minced), onehalf teaspoon salt until they form a paste. Cook the mixture just long enough for it to become heated through.

Soya bean timbales.

1 cup bean pulp.	Onion juice.
1 cup milk.	Salt, pepper
1 egg.	Celery salt.

Bake the mixture in buttered custard cups. Set in a pan of water until the mixture has thickened. Serve with tomato sauce.

Fish cakes.

Ingredients.

$\frac{1}{2}$ lb. cold fish, $\frac{1}{2}$ lb. cold potatoes, 2 oz. soya flour, 1 oz. margarine, salt and pepper,

1 teaspoonful chopped parsley, egg and bread crumbs.

Method.

Flake the fish finely, mash the potatoes, mix them together with the flavourings, form into small round cakes using a little flour. Brush with beaten egg, roll in bread, crumbs and fry.

Mutton roll.

Ingredients.

1 lb. minced mutton (uncooked), 1 oz. soya flour, 1 tea cup breadcrumbs, 1 onion (chopped finely) 1 teaspoonful chopped parsley, pinch herbs, seasoning, sauce or stock.

Method.

Put all the dry ingredients into a basin and mix well together. Add stock or brown sauce and mix to a paste, then form into a roll like a large rissole. Place in a well greased roasting tin, covered with greased paper and bake for 20 minutes. Take out and allow to cool. Take a piece of flaky pastry and wrap it round the roll, brush

over with milk or egg and bake in the oven for about half one hour and serve.

Note:—This mixture can be made into patties and fried.

Rissoles.

Ingredients.

¼ lb. any cold meat, 1 oz. soya flour, 3 tablespoonful breadcrumbs, 1 oz. margarine 1 gill stock, 1 teaspoonful chopped parsley, seasoning egg and breadcrumbs.

Method.

Mince the meat finely and mix in the crumbs, parsley and seasoning. Mix the margarine and soya flour to a paste and stir into the stock until it boils. Mix with the meat, allow it to cool, turn on to the floured board, form into shapes about 3 inches long with rounded ends. Coat with egg and crumbs and fry.

Soya bean yeast raised coffee cake.

1 cup scalded milk (cooled).
1 tablespoon sugar.
½ teaspoon salt.
½ cake of yeast dissolved in ¼ luke-warm water.

1 cup soya bean flour.
3 cups wheat flour.
$\frac{1}{2}$ cup sugar.
1 egg or 1 teaspoon egg substitute.
$\frac{1}{4}$ cup shortening.

Make a sponge of the milk, sugar, salt, bean flour and one cup of wheat flour. Add the dissolved yeast and let the mixture stand over night. Then add the other two cups of flour and the shortening, sugar and egg. Place in shallow pans and let rise until very light when ready to bake, rub the pots with sugar dissolved in milk and sprinkle with dry sugar and cinnamon. Bake about 25 minutes. A few raisins may be added to the dough if desired.

Soya bean and rye bread.

2 cups soya bean flour.
4 cups rye flour.
$1\frac{1}{2}$ teaspoons salt.
1 tablespoon brown sugar.
2 tablespoons shortening.
2 tablespoons baking powder.
$1\frac{1}{2}$ cup milk and water.

Sift-dry ingredients together. Add the milk and water and melted shortening. Beat

thoroughly and put into a well-greased pan and stand in a warm place for 30 minutes. Bake in a moderate oven for 45 minutes.

Soya beans and macaroni.

2 cups soya bean pulp.
2 cups boiled Macaroni.
2 cups canned tomatoes.
1 onion.
1 tablespoon fat salt and pepper.

Brown the onion, finely chopped, in fat, add tomatoes, salt and pepper. Let simmer for 20 minutes. Put through a sieve. Put Soya bean pulp and macaroni in alternate layers in baking dish, cover it well with tomato sauce. Bake in moderate oven until brown.

Soya bean roast.

1 cup grated cheese.
1 cup mashed boiled soya beans.
1 cup bread crumbs.
2 tablespoon chopped onion.
salt and pepper.
$\frac{3}{4}$ cup water.
Juice of $\frac{1}{2}$ lemon.

Cook onion and butter until tender. Add beans, cheese and bread crumbs, salt, pepper

and the grated rind and juice of a half of lemon. Turn into a buttered baking dish. cover with bread crumbs and dabs of butter and bake for 20 minutes.

Maderia cake (without eggs).

Ingredients:–

10 oz. flour, 2 oz. soya flour, 5 oz. butter 9 oz. sugar 9 or 10 oz. milk (½ pint), ½ oz. baking powder, (a small tablespoonful) a little grated orange peel and a teaspoonful of ground mas a pinch of salt.

Method:—

Weigh out dry ingredients and mix together, reserving half the sugar separately. Cream this sugar with the butter and then add mixed and sieved dry ingredients alternately with the milk, keeping a little milk to add last. Beat well. Bake in fairly cool oven for about an hour.

Plain gingerbread.

Ingredients.

14 oz. flour, 2 oz. soya flour, 4 oz. dark brown sugar, 3 oz. margarine, and 1 tablespoonful ground ginger, teaspoonful bicarbonate of soda, 3 gills milk, and 1½ gills treacle (black) ½ teaspoonful mixed spice.

Method:—

Sift flour, soya flour, and sieve together and rub the fat into them. Warm the treacle and milk together and add the soda Mix thoroughly with a knife. Put into a well greased tin and bake in slow oven for, about 2 hours.

NOTE:—4 oz. sultanas or chopped ginger can be added.

Short bread.

Ingredients.

6 oz. flour, 2 oz. soya flour, 3 oz. margarine, 1 oz. butter, 2 oz. sugar, pinch salt.

Method:—

Cream the fat and sugar together, add flour, soya flour and salt sifted together and work in. Turn on to a lightly floured board and knead very well until smooth, shape into a round mass. Put on to a greased and lightly floured baking sheet, mark the edges with little finger, prick with a fork and bake slowly. Can be rolled thinner and cut as biscuits.

Maderia:—

Ingredients:—

10 oz. flour, 2 oz. soya flour, 8 oz. sugar 5 oz. margarine, 2 oz. butter, 3 eggs,

2 teaspoonful baking powder, 3 tablespoonful milk.

Method:—

Cream the fat and the sugar until very light and soft. Sift the flour, soya flour, and baking powder together, add 1 egg and a tablespoonful of flour and beat in very well and do the same with the other eggs. Fold in the remainder of the flour and milk. Put the mixture into a tin well greased and floured and bake in a good moderate oven.

Soya bean fruit cake.

3 cups soya bean flour.
½ cup butter.
2 cups sugar.
4 eggs.
1 pound seeded raisins.
1 nutmeg grated.
2 teaspoons mixed spices.
2 teaspoons baking powder.
2 teaspoons cinnamon.
½ cup wine.

Cream butterine and sugar together; add the egg. Sift flour and baking powder together and add to the creamed butterine,

mixing in a little milk at a time and beating well together for 5 minutes. Bake in a moderate oven 20 to 25 minutes.

Soya bean pancakes.

2 tablespoons soya bean flour.
2 tablespoons white flour.
1 egg or 1 teaspoon egg substitute.
1 teaspoon baking flour.
1 teaspoon salt.

Mix all together with a little milk or half milk and water, to a creamy butter. Fry on a hot skillet.

Soya bean gingerbread.

$\frac{1}{3}$ cup vegetable shortening.
1 cup brown sugar.
2 beaten eggs.
3 tablespoons molasses.
Pinch of soda.
1 cup soya bean flour.
$1\frac{1}{4}$ cups wheat flour.
$\frac{1}{2}$ teaspoon salt.
1 tablespoon ginger.
2 tablespoons baking powder.
$\frac{1}{2}$ teaspoon cinnamon.
$1\frac{1}{4}$ cups milk.

Cream the shortening and brown sugar; add beaten eggs, then mix molasses and soda. Mix and sift the balance of dry ingredients and add alternately with the milk. Beat well, turn into an oiled shallow baking pan and bake in a moderately hot oven.

Soya bean ginger cookies.

½ cup vegetable shortening.
½ cup corn syrup.
1 cup brown sugar.
2 beaten eggs.
2 tablespoons milk.
3 cups soya bean flour.
1 teaspoon ginger.
½ teaspoon salt.
1½ teaspoon baking powder.
1 teaspoon vanila.

Melt shortening and add syrup and brown sugar. Bring to boil, chill thoroughly. Beat the eggs add to them the milk and vanilla and stir into first mixture. Mix and sift the flour, ginger baking powder, and salt and work in. Roll on floured board very thin. Cut with cookie cutter and bake in hot oven.

PUDDINGS.

Baked rice.

Ingredients.

2 oz. rice, 1½ oz. soya flour, 3 gills milk, 1 gill water 1 or 2 oz. sugar, pinch salt.

Method.

Put all the ingredients into a pie dish and bake slowly in a moderate oven for about 2 hours.

Boiled suet pudding.

Ingredients.

3 oz. flour, 4 oz. breadcrumbs, 1 oz. soya flour, 3 oz. suet, 2 oz. sugar, egg, ½ teaspoonful baking powder, milk.

Method.

Chop suet finely or use shreded suet, mix all dry ingredients together, beat the egg with little milk, and add, keeping the mixture rather on the wet side to allow the suet to swell. Put into a greased basin or mould, cover with greased paper or a scalded and floured cloth and boil in water coming almost to the top of the basin.

NOTE:—Two tablespoonful of marmalade, jam, or treacle or golden syrup

can be put in the bottom of the basin or 4 oz. chopped figs or dates can be added to the mixture before boiling.

White sponge pudding.

Ingredients.

3 oz. flour, 1 oz. soya flour, 3 oz. sugar, 4 oz. margarine, 2 tablespoonful breadcrumbs, ½ tablespoonful baking powder, pinch salt, 1 egg, a little milk.

Method.

Cream the margarine and sugar very well, sift the flour, soya flour baking powder and salt together and add with the beaten egg alternately, beat well, add the crumbs and little milk, put into a well-greased basin, cover with greased basin, cover with greased paper and steam in 1 in. of hot water very gently for 1½ hours.

Note:—This pudding can be varied in many ways. The grated rind of two oranges or 2 lemons can be mixed in. 2 tablespoonful of jam or golden syrup can be put at the bottom of the basin. It can

also be flavoured with almond or vanila essence.

Soya bean muffins.

2 eggs
1½ cups milk
1 cup soya bean flour
½ teaspoon salt
2 teaspoons sugar
2 teaspoons baking powder
2 tablespoons melted fat

Sift dry ingredients, add milk gradually, beat eggs thoroughly. Add melted fat and put in greased muffin tins. Bake in hot oven.

Soya bean crust.

1 cup boiled soya bean pulp
½ teaspoon salt
2 tablespoons melted fat
1 teaspoon baking powder
1 egg (beaten)

Combine the ingredients and add enough flour to make a soft dough. Roll out the mixture to about 1/8 in. in thickness on a well-floured board. Cut strips of suitable size to fold for individual pies.

Soya bean Cookies.

½ cup flour
½ cup soya bean pulp
2 teaspoons baking powder
1 egg
2 tablespoons fat
about ¼ cup milk
1 teaspoon fat
1 teaspoon lemon juice
3 tablespoons sugar or syrup

Cream sugar or syrup with the fat. Add the soya bean pulp into which the salt has been worked. Add the milk, the egg well beaten, the sifted flour and the baking powder. Drop by spoonfuls on a greased pans and bake in a rather hot oven 12 to 15 minutes.

Soya bean and rice.

1 pt. soya bean
2 tomatoes or 1 cup stewed tomato
2 teaspoons salt
1 cup rice
1 slice onion

Boil the beans. Cook the tomatoes with the onion. Strain, add the liquid in which the beans have been boiled. Add the salt and cook rice in this liquid, adding more water if necessary. When the rice is soft, combine with the beans and reheat.

Soya bean filled cookies.

½ cup vegetable shortings,
½ cup corn syrup
½ cup brown sugar
2 beaten eggs
½ cup milk
½ teaspoon vanilla
1½ cup soya bean flour
2½ cups wheat flour
1 teaspoon salt
½ teaspoon salt baking powder
½ teaspoon nutmeg
½ teaspoon ginger
½ teaspoon cinnamon

Cream the shortening, sugar and syrup. Add well-beaten eggs then alternately the milk and flavouring with the sifted dry ingredients. Have ready the following filling and when filling is cooled roll dough thin, cut with cookie cutter and spread.

PASTRY.

Suet crust.

Ingredients:—

10 oz. flour, 2 oz. soya flour, 5 oz. suet, ½ teaspoonful baking powder, water.

Method.

Sift flour and baking powder into a basin and mix the suet. Mix to a dough with sufficient water, using a knife. Turn on to a board, knead lightly, roll out and use.

NOTE:–This crust can be used for pudding, Jam roly poly, dumplings and boiled fruit pudding.

Sago or tapioca pudding.

Ingredients:—

2 tablespoons tapioca or sago, tablespoonful soya flour, 1 pint milk, 1 tablespoonful sugar, pinch salt.

Method :—

Put tapico or sago, sugar and salt in a piedish, then mix soya flour to a smooth paste, using some of the milk, add to tapico or sago. Stir the rest of the milk to the other Ingredients and bake in a slow oven for 1 hour.

Soya bean cheese.

Soya milk will sour in a warm place and may be used in the same manner as sour animal milk. An excellent cottage cheese may be made from it. The follwing recipe has kindly been supplied by the Diet Department of the Stanboroughs Hydro, Watford.

Ingredients.

One quart soya milk, juice of one lemon, half a teaspoonful Be–vita or Marmite, grated onion, one tablespoonful soya oil or cream, chopped tomato, salt.

Method.

Add sufficient lemon juice to soya milk to curdle it. Heat to separate curd from whey and strain through a fine muslin cloth. To the curd add one–half teaspoonful of Be–vita or Marmite and a small amount of grated onion. One tablespoonful of soya oil or cream may also be added if desired and a small amount of finely chopped tomato. Salt to taste.

This is an excellent food. It contains vitamins A, B, C, D, and E. The vitamin C is no present in the soya milk but is

derived from the lemon and tomato juice. The Be–vita or Marmite provides an additional supply of vitamin.

Preparation of tofu.

Prepare soya bean milk as described in the Chapter on milk. A small quantity of Mag, Chloride about one p. c. solution is dissolved in hot water and is mixed thoroughly in hot soya bean milk. Through the action of mag Chloride, the proteids are coagulated. Water which accumulates at the top is thrown away. The solid substance which remains at the bottom is dipped out when still warm into sq. wodden trays about 3″ depth in which cloths have previously been spread. The end of the cloth is folded so as to absorb the water. It is then subjected to pressure by piling several trays together with stone at the top. After the water has been pressed out the cake is sufficiently solid to stand handling. It has the constancy of cream chese. Tofu is specially rich in protein, fat and mineral substances which seems to justify the Chinese proverb, "Tofu is meat without bones".

(The recipes given below are taken from The Soya Products Co. and Chicago Bean Bread Co.)

Chicken soy cake (tofu).

$\frac{1}{4}$ lb. soya cake.
1 cup thinly sliced celery.
1 pt. chicken stock.
1 small onion.
1 bay leaf.
1 cup dried or shredded chicken.
$\frac{1}{2}$ level teaspoon salt.
$\frac{1}{4}$ level teaspoon pepper.
$\frac{1}{4}$ level teaspoon paprica.
2 tablespoons flour.
1 tablespoon chicken fat, butter or lard.

Heat the fat. When hot, put in the celery and onions. Cover and salt until they turn colour (do not brown), stirring with a fork occasionally to prevent burning. Covering preserves the flavour and prevents turning colour too soon. About 10 minutes should be sufficient. Then add the cold stock, soya cake (tofu), chicken and seasonings. Simmer gently from 20 to 30 minutes. Thicken with flour and water and serve

with rice. This makes $1\frac{1}{2}$ pt. When used again, reheat in a double boiler. Other meats and combinations may be prepared in the same way.

Soya cake (tofu) with tomatoes.

$\frac{1}{2}$ lb. soya cake
1 qt. canned or stewed tomatoes.
1 large onion thinly sliced
1 cup thinly sliced celery
2 tablespoons lard
2 tablespoons flour
pepper and salt to taste

Put into a sauce pan the lard and when hot add the celery and onion. Cover and saute till they commence to turn colour (do not brown), stirring with a fork occasionally to prevent burning. Then add the tomato (cold) and when hot add the soya cake and seasonings. Simmer very gently from 20 to 30 minutes. Thicken with flour dissolved in a little cold water, and serve. More onion may be added if desired, and if the tomatoes are very solidly packed it may be necessary to add a little water to make enough sauce. This makes $1\frac{1}{2}$ qt.

Soya Cake (tofu) with tomatoes and cheese.

1 pt. canned or stewed tomatoes
1 cup boiled rice
2 stalks celery sliced very thin diagonally
½ onion cut fine
¼ lb. soya cake cut in pieces
¼ in. thick.
½ cup cheese cut fine
Season to taste

Mix the ingredients cold. Heat in a saucepan from 20 to 30 minutes. Then put in a baking dish. Sprinkle with bread crumbs and brown very quickly in a very hot oven or under the bar of a gas range.

Mushrooms with soya cake (tofu).

½ lb. soya cake
¼ lb. mushrooms
2 tablespoons butter
2 tablespoons flour
1 pt. milk
1 small onion thinly sliced
Pepper and salt to taste.

Heat in butter in a saucepan; then add the celery and onion. Cover and saute till

they commence to turn colour (do not brown), stirring with a fork occasionally to prevent burning. Add the milk and stir till hot; then add mushrooms, soya cake and seasoning. Transfer to a double boiler and cook for one half-hour. Thicken with the flour dissolved in a little cold water and serve in paper or pastry shells. This makes about 1qt.

Potatoes with soya cake (tofu).

½ lb. soya cake
4 cups diced raw potatoes
1 large sliced bacon minced fine
1 large onion sliced thin
2 tablespoons bacon fat or lard
2 tablespoons flour
Pepper and salt to taste.

Saute the bacon, onion and potatoes, together till they commence to turn colour (not brown) stirring with a fork occasionally to prevent burning. Cover with cold water and cook one half hour. Add the seasoning and soya cake and keep hot (do not boil) 20 to 30 minutes. Thicken with flour dissolved in cold water, and serve. This mixture may also be put in a baking dish

when the soya cake is added, and browned in a hot oven.

Note:—This recipe may be varied by using equal parts of potato, celery, onion and carrot.

Soya cake.

Heat the butter in a saucepan, and when hot add the celery and onion. Cover and saute until they commence to turn colour (do not brown) stirring with a fork occasionally to prevent burning. Then add the milk and tuna fish and bring to a boil, stirring constantly. Add the soya cake and seasonings and transfer to a double boiler. Cook for 30 minutes. Thicken with flour dissolved in a little cold water and serve. This makes enough for two people.

Salted tofu.

An easy method of salting tofu ready for any use in hot or cold dishes, is to place the amount needed in cold water with two tablespoons of salt to a pound of tofu. Bring slowly to a boiling point. Remove from the fire and allow to cool.

Tofu for soup.

Tofu will be found in a nutritive and palatable addition to any kind of soup. It may be mashed or diced.

Tofu and fish.

Boil two stalks of celery (cut very fine) with a tablespoon of minced parsley in two cups of boiling water. When the celery is cooked thicken it with a tablespoon of egg substitute and one teaspoon of butter. Dice very fine one pound of tofu and with a small can of any kind of fish, add to the creamed mixture. Garnish dish with parsley and serve.

Cabbage or cauliflower soya cake (tofu).

Allow about 2 oz. of soya cake per person. Shave the cabbage as for cold slaw or break the cauliflower into small pieces. Cover with cold water and bring to a boil. Add the soya cake, season to taste andcook slowly about 30 minutes. Thicken with flour dissolved in a little cold water and serve.

Eggs a la caracas with soya cake (tofu).

1 cup soya cake cut in $\frac{1}{4}$ in. pieces.
1 cup tomatoes.

¼ cup grated cheese.
few drops onion juice.
few grains cinnamon, cayenne.
2 tablespoons butter.
3 eggs.

Melt butter. Add soy cake, tomatoes, cheese, union, juice, cinnamon and cayene. Heat from 20 to 30 minutes. Add eggs well beaten. Cook until eggs are of creamy consistency, stirring and scraping as in scrambled eggs.

Soya cake (tofu) with tuna fish.

¼ lb. soya cake.
¼ small can tuna fish.
1 cup milk.
½ cup thinly sliced celery.
½ small onion thinly sliced.
1 tablespoon butter.
1 tablespoons flour.
paper salt and paprika to taste.

Tofu with cheese.

Prepare a small amount of cream sauce to which add ¼ lb. of grated cheese. When this is thoroughly dissolved and blended, add one lb. diced, salted and cold tofu and ¼ lb.

of green sprouts. Mix well and place in a casserole. Cover with cracker crumbs and dot with butterine. Bake until set.

Creamed tofu in ramekins.

$1\frac{1}{2}$ cups salted tofu ($\frac{1}{2}$ in. cubes).
$\frac{1}{2}$ cup mushrooms ($\frac{1}{2}$ in. cubes).
2 tablespoons butterine.
3 tablespoons corn flour.
$1\frac{1}{2}$ cups milk or meat stock.
$\frac{1}{8}$ teaspoon celery salt.
$\frac{1}{8}$ teaspoon paprika.
1 teaspoon salt.
2 teaspoons mushrooms ketchup.
1 tablespoon butterine.
1 cup bread crumbs.

Heat the fat in a pan thoroughly. Then add the corn flour and next the liquid, making a sauce. Season and add the tofu and mushrooms. Place in a greased ramekins; cover with the bread crumbs which have been stirred into a teaspoon of butterine. Bake in a hot oven 15 or 20 minutes. Serve with a slice of lemon.

Tofu and vegetable stew.

2 Heads of celery.
1 tablespoon kitchen bouquet.

2 tablespoon flour.
1 lb. tofu.
2 good sized onions.
$\frac{1}{4}$ lb. bean sprouts.
1 tablespoon butterine.
salt and pepper to taste.

Cut the celery into 1 in. length, also cut up the onion and boil until soft in. 1 qt. of water, to which salt and pepper have been added. Wet the flour with the kitchen bouquet and melted butterine and pour into the celery and water it was boiled in. Cut the tofu into strips or dices and add the thickened vegetables.

Tofu and bacon.

Split salted tofu and place in a baking dish. Put two thin slices of bacon on top and crisp in a hot oven.

Pickled tofu.

Cut in half two cakes of tofu and stick two cloves in each part. Sprinkle with salt and teaspoon ful of sugar place on the fire one pt. of vinegar, one good sized onion, one-half teaspoon whole mixed spices (tied in a bag) and boil for two minutes. Remove spice bag

and set to cool before pouring over tofu. One cup of bean sprouts added will be an improvement.

Tofu cakes.

Mash sufficient warm salted tofu to make three cups. Add one cup of sausage or ground left-over meat (in using left-over meat be sure to season it.) Make into small cakes, dip into cracker crumbs or corn meal and fry quickly in hot fat.

Curried tofu.

1 lb. tofu (diced).
2 tablespoons oleomargarine.
1 tablespoons flour.
1 teaspoon salt.
1 teaspoon curry powder.
1 chopped onion.
1 cup strained tomatoes.
$\frac{1}{4}$ teaspoon white pepper.

Put $\frac{1}{2}$ of the oleomargarine in the frying pan and in it cook the onion slowly without browning until it is soft. Add the curry powder and tofu, and shake the pan over a quick fire for two minutes. Place the other half of the oleomargarine in another frying

pan, and when hot add to it a flour. Stir well, then add the salt, pepper and tomatoes. Let come to a boil and then pour over the tofu in the other pan. Cover and cook slowly for three minutes. Boiled rice makes a nice addition to be served with dish.

Tofu in pine-apple jelly.

1 packet gelatine.
1 cup crushed pine-apple.
½ cup sugar.
½ lb salted tofu.
1 pt. water.

Boil sugar and pineapple in water until sugar is entirely dissolved. Stir in the gelatine and when thoroughly disssolved, add the salted tofu (diced). Place in a mould and allow to set in a cool place for five minutes. This is delicious when served with whipped cream.

CHAPTER XVII.

Diabetic dishes, Mahatma Gandhi's experiments at Magan Wadi and opinion of Scientists on Soya Bean.

Soya bean and diabetes.

Soya flour is of great importance in diebetic dietary. It is starchless and the sacchides content is low,the carbohydrate content being mainly in such forms as to give energy, without being provocative to the appearance of urinic sugar. Modern diabetic dietary practice recognises the necessity of a strict control of carbohydrate concomitant, giving sugar in negligible proportions and soya flour adequately fulfils these essential conditions.

Dr. Jozef Szanto in his essay "Soya flour in the Treatment of Diabetes," which appeared in the Hungarian monthly, Therapie, January, 1928, writes that in the kitchen of the sanitarium under his management soya flour has been used for a considerable time in various diabetic foods. As an example,

here are a few recipes for some farinaceous dishes:—

Omelette for five persons.

Beat up ten whites of eggs into a thick froth and mix well ten yolks of eggs and $1\frac{3}{4}$ oz. of soya flour, adding ten saccharine tablets. Place the mixture in a well-buttered mould powered with soya flour and fry gently for fifteen to twenty minutes.

This dish can be served with wine sauce prepared as follows:—

Beat up $\frac{1}{2}$ pint sour white wine, four yolks of eggs, three tablets of saccharine with a little grated lemon peel, then warm and work in the thick froth of four whites of eggs.

Each person consumes $1\frac{1}{2}$ drams of carbohydrates 10 drams of protein and 327 calories.

Pudding for five persons.

Mix up $\frac{1}{4}$ pint milk, $1\frac{1}{3}$ oz. butter and 2 oz. soya flour, and put the mixture in a saucepan to boil on a good fire; keeping stirring till the mixture ceases to adhere to the saucepan. When cold mix in five yolks of

eggs and five tablets of saccharine, then beat in the thick froth of five whites of eggs. Place the mixture in a well buttered pudding mould powered with soya flour and leave to steam for fifteen minutes. It can then be served with vanilla custard made in a similar way to wine sauce, with the difference that milk and half a bar of vanilla is used instead of wine.

Each person consumes $3\frac{1}{2}$ drams of carbohydrates, 10 drams of protein and 313 calories.

Pancake for five persons.

Beat up $\frac{3}{4}$ pint cream, ten yolks of eggs, $1\frac{3}{4}$ oz. soya flour and three tablets of saccharine till well mixed and fry in a shallow frying pan. It can be stuffed with hazel nuts sweetened with saccharine, almonds, or with cream cheese.

Each persons consumes $4\frac{1}{2}$ drams of carbohydrates, $6\frac{1}{2}$ drams of protein and 160 calories.

If served for dinner with the addition of 7 oz. vegetable for diabetics and $3\frac{1}{2}$ oz. of meat,the meal does altogether contain more

than 3 to 6 drams of carbohydrates and 1½ to 1¾ oz. of protein.

This is just the right diet for a patient whose allowance is 2½ oz. of carbohydrates. Finally, there follows an example of a dish for diabetics, prepared with soya flour and without it:—

Stuffed lettuce.

Quantity	Protein	Fat
2 lettuces	...	...
7 oz. mincemeat	40	12
1 Egg	6	6
1 oz. butter	...	25½
	46	43½
2 lettuces	...	...
3½ mincemeat	20	6
1¾ oz. soya flour	20	10
1½ oz. butter	...	34
1 Egg	6	6
	46	56

The cost of the second recipe is about 20 per cent, less than that of the first.

Soya bean coffee for diabetic patients.

When properly roasted and prepared the dried beans of any variety make an excellent coffee substitute. During the Civil War the soya bean was used rather extensively in the southern States as a coffee substitute. For a long time seedmen sold the Ito San variety under the names Coffee Berry and Coffee bean. In some parts of Europe especially Switzerland, Japan and Southern Russia Soya Bean Coffee is prepared and put in small packages for the market. This product is ground very fine and has much the appearance of coffee essence. Prepared as coffee Soya Bean gives the liquid of the same colour and odour as coffee but it has got some what the flavour of a cereal beverage. Those who are fond of cereal drinks pronounce the Soya Bean beverage to be the best.

According to Li Yu Ying and Grandvoinnet 1911–1912 the Soya Bean dried and roasted has the following composition.

Water 5·27, Cellulose 4·97, Carbohydrates 34·76 fat 18·01, Total material soluble in water 49·07.

For diabetic patients use saccharine tablets instead of sugar.

SOYA BEANS.

(BY M. K. GANDHI.)

(FROM "HARIJAN NOVEMBER 1935.)

Shri Narhar Bhave of Baroda, who has given his three gifted and gentle sons, Vinoba, Balkrishna and Shivaji to national service, is himself a careful observer, 61 years old. He is living almost wholly on milk and 6 ounces of soya beans and is keeping perfect health and strength. He is of opinion that soya beans help him to avoid constipation which milk alone or milk taken in combination with cereals and vegetables could not do. Soya beans have in his opinion helped him also to avoid flatulence which other pulses or milk produced. He has come to this conclusion after an unbroken experience of over ten months. I may add that Shri Bhave used to suffer from gout and corpulence and had a trace of diabetes. He got rid of this triple disability by mere careful dieting. In imitation of Shri Bhave the inmates of Magan-

wadi including me have been trying soya beans for the last few days. It is too early yet to pronounce any opinion for ourselves. Each inmate gets a heaped dessert spoonful per day. This is how the beans are cooked. Clean the beans of foreign particles or dirt, wash in cold water and soak at least for twelve hours, and not more than eighteen, and drain off superfluous water. Put these beans in boiling water and cook for fifteen minutes on a quick fire. No salt or soda to be added while cooking. Salt may be added after. At Maganwadi we steam them for two hours.

Let those who are interested in food reform from the poor man's point of view, try the experiment. It should be remembered that soya beans are a most nutritious diet. It stands at the top of all the known articles of diet because of its low percentage of carbohydrates and high percentage of salts, protein and fat. Its energy value is 2,100 calories per lb. against 1,750 of wheat and 1,530 of gram. It contains 40 per cent of protein and 20·3 per cent of fat against 19 and 4·3 respectively of gram and 14·8 and 10·5 of

eggs. Therefore no one should take soya beans in addition to the usual protein and fatty foods. The quantity, therefore, of wheat and ghee should be reduced and *dal* omitted altogether, soya beans being themselves a highly nutritious *dal.*

MAHATMA GANDHI'S VIEWS ON "BALANCED DIET" FOR THE POOR EACH MEAL COSTS 6 to 7 PICES.

A talk to Village Workers.

Taken from Harijan November 1935.

I have referred in one of my weekly notes to the talk given by Gandhiji to the village workers who were our guests on the 22nd October. Here is a gist of it. M. D.

THE MENU.

As today's menu was selected by me with some careful thought, and especially with a view to the needs of village workers, I must speak to you about it at some length. The idea was to provide you with food, nourishing and yet within the means of an average villager and within the possibility of an eight hours' minimum wage as we have fixed it, i.e. three annas.

We were 98 diners today and the total cost of our food was Rs. 9–14–3, which means that each meal cost slightly more than 6 pices. Here are the details :

					Rs. as. ps.
36	lbs.	Wheat flour		...	1– 8– 0
12	,,	Tomatoes		...	0–11– 3
4	,,	Jaggery		...	0– 6– 3
24	,,	Red gourd		...	0– 7– 6
6	,,	Linseed oil		...	1– 2– 0
25	,,	Milk		...	3–13– 0
4	,,	Soya bean		...	0– 6– 0
4	Cocoanuts			...	0– 4– 0
16	Koth fruit			...	0– 2– 0
	Tamarind and salt			...	0– 2– 3
	Fuel			...	1– 0- 0
			Total	...	9–14– 3

Vinoba had passed on the suggestion to me that I need not worry about giving all of you *roti* but might simply give you wheaten porridge (that we have here every morning) and thus save a lot of trouble. No, said I to myself, you young men whom God has given strong teeth must have good hard well baked *bhakri*, which anyone can make, which one can easily carry on one's person from place

to place, and which can keep for a couple of days. Before the dough was kneaded it was treated with linseed oil. This rendered it both soft and crisp. Then, as we must have some greens and raw vegetables, we had tomatoes and two chatnies—one made of *Koth* fruit available in plenty in these parts and another made of leaves available in our garden. *Koth* fruit is known for both its aperient and astringent properties, and jaggery goes well with it and makes a delicious chatny. The other chatny contained some cocoanut, tamarind and salt to spice the leaves. Green leaves must be eaten by us in some form or other, in order that we may get proper vitamins in our diet. The vegetable chosen was the cheapest available and grows everywhere in our villages. You will see that I allowed the use of tamarind in the preparation of chatny. In spite of the popular prejudice against tamarind, it has been found that it is a good aperient and blood-purifier. I gave copious doses of tamarind water to one of the inmates suffering from malaria with very good effect and have tried it in several cases of constipation.

SOYA BEAN.

Milk is an essential article of diet. Your menu contained half a pound of milk, but you must have seen that I gave you no ghee. I hope, however, that you did not miss it. For I gave you soya beans and oil. Soya beans are rich in oil (28 per cent) and proteins (40 per cent). Groundnuts also are rich in oil, but they have the disadvantage of containing too much starch from which soya beans are comparatively free. Milk with soya beans give us almost all that we need in the shape of fats and there is no need for ghee at all. Why then go to all the wasteful trouble of making ghee? And where procuring good ghee is a doubtful proposition, why have spurious ghee? But milk or buttermilk we ought to have, no matter how little. Medical men say that it helps in the assimilation of the vegetable fats and proteids. Therefore ghee you can omit with impunity. I had recently two little children under my care whose diet I carefully regulated. I cut out ghee from it and found that they were none the worse for the cutting out of ghee. Of course I gave them as much milk as they wanted.

Our menu has cost us a little more than 6 pices. It was a full meal and the other meals need not be so heavy as this. They, therefore, need not cost more than an anna or so. Milk may be omitted for the other meals. Wheat *bhakri*, soya bean and chatny should be quite enough.

TWO MAIN DUTIES.

So this is one of the two main things you have to do–to ensure to villagers a balanced diet, and to content yourselves with the same. There may be some who burden their diet with useless articles and many whose diet is badly deficient in vitamins. You have to introduce the right kind of diet to them. You will learn cow-keeping yourselves and encourage cow–keeping among villagers. It ought to be considered a shame that milk is not available in many of our villages. The second main duty is sanitation–a most difficult thing indeed. But if you have succeeded in introducing the right kind of diet and making the sanitation of your village tolerably good, you will have rendered human bodies worthy of becoming temples

of God and efficient tools for doing a good day's work.

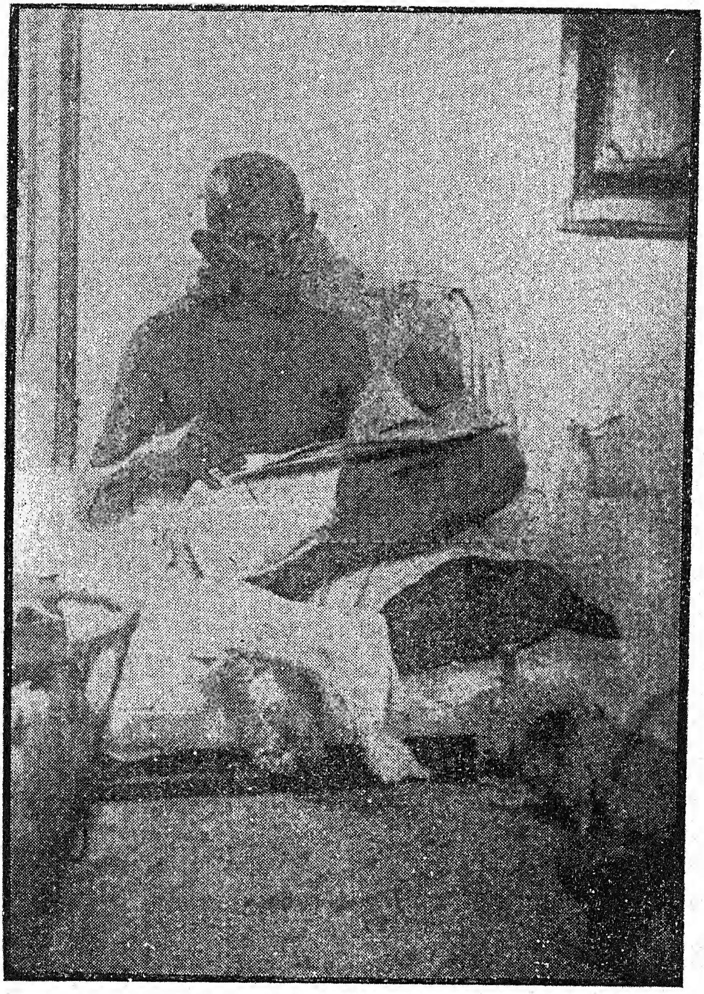
SOYA BEANS

DIETETIC EXPERIMENTS.

(BY M. K. GANDHI.)

(From Harijan 19-10-1935).

The reader must have seen the difficulty of procuring clean, wholesome, unadulterated ghee, revealed in the preceding paragraph. His own personal experience also must be identical. There are places where it is impossible to procure unadulterated ghee. It was partly with a view to getting rid of this eternal problem of getting good ghee that Gandhiji has been casting about for a substitute of milk and ghee. The high protein and fat content of soya beans and their procurability on the premises, combined with the successful experiment of Sjt. Narhar Bhave, encouraged Gandhiji to start the experiment in Maganwadi last week. Oil and ghee and part of the wheat ration was cut out of the dietary of those who joined the experiment and substituted by a soya bean



Mahatma Gandhi who uses Soya bean
at Maganwadi, (Wardha C. P.).

ration equal in dietetic value. It is difficult yet to say anything about the results of the experiments, but one might safely say that it is no longer the bugbear that it once used to be because of the unpleasant taste of soya bean milk. We soak the beans for a few hours and steam-cook them and serve them whole. The taste is similar to that of the bean known as *val* in Gujarat and Maharashtra and sometimes similar to that of cooked groundnut. As it swells to more than twice its size it is difficult to consume it as much as you do other beans and it requires a good deal of mastication. Let the reader also know that we have grown soya beans on our own ground plenty enough for our experiments.

THE RESULTS OF THE EXPERIMENT MADE IN MAGANWADI.

It is too early to draw deductions as yet. It may be said that the weight of the inmates has kept constant. In a few cases there has been a decided increase—in one case as much as 4½ lbs. in a fortnight. Ghee has been stopped since the close of the first week.

The absence of it has yet made no impression on the weight. One ounce of oil is being issued instead. The ration of beans has been increased for the current week from two ounces to three per head. The bean is served both morning and evening. They are soaked for some hours and then cooked well. Water in which it is steamed is strained out and tamarind and salt added to it. It makes a very popular soup. To the bean after straining are added linseed or *til* oil and salt making a tasty dish. In the morning the bean is served with *chapati* or *bhakhri* and in the evening with rice. The bean requires to be chewed well. No ill effect has yet been reported.

WHAT MEN OF SCIENCE SAY ABOUT SOYA BEAN.

"I strongly advocate the more generalized use of soya bean in India in my evidence, and in the statement submitted by me, to the Royal Commission on Labour.

Soya bean is a rich source of calcium–a mineral which is commonly deficient in some of the national diets of India.

The *ash* of soya bean contains 6·12 per cent of calcium and 28·66 per cent of phosphoric acid.

* * * *

Soya bean is one of the few seeds cotaining the three vitamins, A, B, and D which is indispensable in the staple food consumed by mankind and necessary also in food for cattle. I would advise you to advocate the use of " soya bean milk " for infants and young children who cannot obtain a sufficiency of mothers' or cows' or other milk.

—Major-General Sir Robert Mc Carrison,
Kt., Director, Nutritional Research,
I. R. F. A.
Coonoor.

Soya bean is one of the most important agricultural plants of Northern China and Japan. The bean like seeds which contain about 20° oil and 40° proteins are used for human food and for feeding animals.

Beans are digestible and contain fully as much crude protein and considerably more digestible fat than linseed meal. Being

rich in protein and mineral matter they are well suited to growing animals.

—Director, *Imperial Institute of Agricultural Research, PUSA, India.*

The protein of the soya bean is the only vegetable protein which in nutritive value and digestibility equals the expensive animal protein.

—*Bulletin No.* 519 *of* 1939 *of Agriculture in Sindunder the Barrage Cannals System.*

The Biological value of soya bean protein is very high. It contains almost all the important amino acids, particularly glycine and trypto-phane and lycine. In fact the protein of soya bean is very similar to that of cow's milk and animal muscles.

Soya bean contains lecithin more than any other plant and therefore could be used for cure of nervous diseases. The lecithin of soya bean is, according to Dr. J. Freud, identical with that in egg yolk.

From the point of view of growing soya bean in India, we find that it grows splendidly under varied conditions and it does not

cost more to grow this crop than any other pulses.

In the course of human nutrition, especially amongst vegetarian India, soya bean is destined to play a very important part, if introduced. Sprouted seeds can make excellent vegetable.

Biological tests regarding the nutritive value of Indian pulses have been carried on by Prof. S. P. Niyogi and his co-workers. Prof. D. L. Sahasrabudhe has analysed various Indian food stuffs, the results whereof are embodied in departmental bulletins; but I may say that soya bean can be singled out as the best pulse so far known.

—Livestock Expert to Government Bombay Presidency, Poona.

This is the only crop amongst pulses, oilseeds, and grains which has got the two body-building ingredients namely fat and protein in good quantity.

Very recently small seeded yellow soya bean seed has been imported from Manchuria. This seed grows exceedingly well and produces bigger seed here than that produced at its own place.

Soya Bean.

There is no other food crop which is cheap as well as rich in quantity of proteins and fat as soya bean.

—Botanist, Agricultural Research Station Sakrynd (Sind).

Soya bean sprouts are considered a great relish and are eaten as a common vegetable throughout the whole year. The sprouts are boiled with salt, bean oil or rape-seed oil. They are also boiled and eaten with rice and millet. Salads of various sorts may also be prepared with the sprouts as the chief ingredient.

—Pamphlet No. 8 on " Balanced Diets.

CHAPTER XVIII.

Chinese and Japanese soya bean dishes.

Toffu or soya bean curd.

When seed or mineral salt is added to soya bean milk coagulation takes place which is similar to that produced by the same means in animal milks. If the precipitated mass is allowed to drain and is subsequently washed out a white cheese or curd is produced. This curd or cheese is called " Teoufu " by the Chinese "Toffu" by the Japanese.

To the Buddhist priests and the monks as well as to the strict adherents to Buddhism who take no meat or animal food, it forms a very indispensable article of diet. All the protein is supplied by Toffu in the diet of the orientals viz. Chinese and Japanese.

Digestibility of toffu (soya bean curd).

According to the results of digestion experiments carried on by Oshima as much as

95 p. c., of the protein 93 p. c. fat, 90 p. c. of carbohydrates were found to be digested.

Utilization of toffu.

Tofu in its natural state is tasteless but it forms the basis of a great variety of preparations. It is eaten in fresh condition with soya sauce. But very often it is cooked or fried in oil and eaten with soya sauce, it is then very palatable.

Toffu khan.

This bean curd is much like the ordinary bean curd, but instead of being white has a rich brown colour which has been given by dipping the bean curd squares in burnt millet-sugar sauce. Fine salt is rubbed on them. Toffu Khan can be kept for several days and is eaten in soups.

Toffu nao.

It is prepared by adding a very little magnesium chloride or gypsum and is not pressed. It is eaten as a broth with sweet oil, sauce and vinegar sprinkled over it. It is also eaten as a stiff broth with the addition of finely chopped meats and some spices.

Tze toffu. (fried bean curd).

The fresh bean curd is cut into small squares and fried in deep fat. After a few minutes the curd pieces float on the surface and they are then taken out. This product is often fastened on bamboo fibres and can be kept for a long time. They are eaten with syrup as fritters.

Chien chang toffu. (thousand folds).

This is prepared by placing their layers of bean curd on cloths on the top of one another and subjecting them to considerable pressure and allowing to dry for a short time. The layers of bean curd are then removed and rolled together like a jam roll when allowed to mold for several days it is fried in oil has a meat like flavour.

Hsiang khan.

This product is made like the ordinary bean curd but great pressure is applied to drive out as much water as possible. The squares are first soaked in bean sauce to which powdered spices and burnt millet sugar have been added and then are thoroughly dried out. The curd gets hard

and can be kept for a very long time. It is eaten sliced in soup and in various vegetable dishes.

Kori toffu. (frozen toffu.)

The fresh bean curd is cut into small pieces and exposed to severe cold weather. By freezing the vegetable proteins shrinks and forms a pornis cake permitted with ice crystals. This frozen cake can be thrown out and dried. It forms a product much resembling gluten bread in appearance. This form of tofu is soaked in water and then used in much the same manner as fresh toffu.

Preservation of toffu.

The chinese preserve toffu in many ways. In fresh state it can be kept for several days simply by putting in water. It is also preserved in loans which are cooked in decoction of turmeric roots. It is also preserved in salt. It is cut into small pieces and preserved in rice, brandy. When smoked it keeps very well.

Natto.

A sort of a vegetable cheese prepared from soya bean, has long been used by the

Buddhists and is now used in considerable quantity by the Japanese. The preparation differs according to locality.

Tokio natto and Kyoto natto etc.

In preparing Natto the Soya bean are boiled in water for about 5 hours to render them soft. The material when hot is rapped in small portions about a handful of rice straw and the bundle is tied at both ends and placed in a ceklar or room heated by charcoal or hot water. The room is then closed for about 24 hours, the temperature ranging from 35° to 40° C. This allowing the cooked beans ferment in the warm moist atmosphere. Natto is highly nutritious and is easily digestible. The average composition of Natto water 61·84 albumen 19·26 fat 18·17, carbohydrate 6·09 and cellulose 2·80–1·84.

Hamanan natto.

It is a kind of soya bean cheese. It is manufactured in Central provinces of Japan. It is prepared much like Natto but it has somewhat different flavour and texture.

In the preparation of Hamaon Natto the soya beans are thoroughly washed and boiled

to softness, spread on the straw mat and mixed with the wheat flour in the proportion of 6 litres of flour to 10 litres of soya bean. Mold are soon developed after which the mixture is exposed to the direct sunlight for 3 days probably to kill the Gungi and is then put in flat tubes. After about twelve days some salt and ginger is added. The entire mass is then kept in tubes under pressure for about 30 days.

According to some the composition of Hamonan Notto has the following composition:—

Albuminocle Nitrogen.	3·57
Fat.	3·44
Fibre.	6·87
Total carbo (excluding cellulose).	8.40
Total ash including salt.	18·54
Moisture of fresh sample.	44·73

Yuba.

When Soya bean milk is boiled, a film forms on the surface. This film known as Yuba has been prepared since ancient times in China and Japan and is very popular food stuff.

In the preparation of Yuba Soya bean milk of best quality is boiled for about 1 hour in a copper pan over a slow fire. A small quantity of auramine is added which tends to produce a thick film. The film is removed from the milk by passing a stick underneath the surface, the film thus hanging on twofold. It is dried slowly on a galvanised net on a charcoal fire resulting in a thin yellowish shut.

The best quality of Yuba is glossy and of a cream yellow colour and the first film is the best

Yuba is much valued on account of its high protein content.

The composition of Yuba is as under:—

	According to Oshima,	According to Nagoa.
Water	18·31	22·85
Protein	49·65	51·60
Fat	18·00	15·62
Carbohydrates	11·82	7·31
Ash	2·22	2·82

Misso.

Misso is consumed in greater quantity by the rural and working population of China and Japan. It forms an indespensible part of

the daily menu of the farmers. They prepare Misso for their own use. It has been estimated that the daily consumption of Misso per person in rural areas in Japan is about 40 grammes.

On preparing Misso the beans are first steamed for 25 hours, firstly with strong heat and later very gently. When the beans are properly cooked they are rubbed into a thick uniform paste to which are added proper amount of kojii salt and water. The whole mass is then well mixed and stored in the special vat. The temperature of the mixture is kept 15 to 20° C. The proportion in which the different ingredients of Misso are employed are not always the same. There are various kinds of Misso which are distinguished by colour test and keeping properties and are prepared by somewhat different processes. The difference consists chiefly in the use of barley or rice Kojii the amount of common salt is added a longer or shorter fermentaion and the temperature to which it is subjected. White Misso and red Misso are the two most important products of this kind.

Soya sauce.

Shoyu or soy sauce is a dark brown liquid with a pleasant aromatic odour and a peculiar salty taste suggesting a good quality of milk extracts though more salty and pungent. This suace is indespensible in the dietary of the Chinese and the Japanese people. This sauce is very popular for use in cooking and it serves as relisher condiment to increase the flavour and palatability of the diet. It is estimated that 2·5 ounce of soy sauce is consumed daily by each Japaneses.

The manufacture of soya sauce forms one of the important industries of Japan. The yearly product amounts to over 200,000 lbs. It is also produced very extensively throughout China. The brewing of sauce has become a water established industry in Hawaii.

Soya sauce is preapred from cooked and ground soya beans, roasted and palmyrised wheat (barley is sometimes substituted for wheat, as giving a sweeter taste. Salt water and culture water is known as ferment.

There are four principal stages.

(1) Preparation of soya beans and wheat.
(2) Preparation of rice ferment (Konji)
(3) Ripening process.
(4) Pressing and boiling.

Small baskets are placed in the centre of large jars, full of phermented Soya bean and brine. The sauce accumulates in these baskets and is dipped into ready for consumation. In general manufacturers use nearly equal parts of Soya bean, Wheat and salt, and about double the quantity of water. The density of brine differes in the cheaper and in the better grades of the sauce for the best grades of sauce the ingredients are mixed according to Sawar as follows:—

Soya bean 15 parts; wheat 15 parts, salt 13·5 parts and water 27·5 parts.

For the manufacture of the soya sauce the soya beans are boiled in large iron vats or candrones from 4 to 6 hours and then left to cool about 18 hours. This mass is mixed with an equal amount of wheat which has been browned in pans and pulvarised. The whole mixture is poured into moulds

which are in a long narrow chamber built of bricks or stone or sometimes in a sort of cellar with a temperature of at about 36° C. Spores of fungus are added the mass thoroughly mixed and allowed to stand until slightly covered with fungus. The salt is desolved in boiling water in proportion mentioned above and added to the fermented mixture of beans and wheat. This mass is then emptied into large vats or jars and lifted the ferment from 6 months to a year, and sometimes as long as 5 years. During the process of ripening the mass, is stirred thoroughly twice daily in summer, but in winter once every two or four days. The fermented mass after ripening is transferred into a large press and the liquid sauce is pressed out boiled to two to three hours and put into small kegs or jars.

Value and Composition.

Soya sauce is not only valuable as food because of proteins and carbohydrates it contains but on account of the peculiar and appetising flavour which imparts relish to other dishes.

Soya bean confectionery.

In China the dried soya beans are used in the preparation of numerous sweetmeats and confection. The dried beans are boiled in water as condied beans. Soya bean is ground into powder and used in pastry products or the beans are roasted and ground into a fine powder or flour with which sugar is added, and is used as a filling for different sweetmeats.

The manufacture of milk Chocolate of which the roasted 5·13 ground into a fine powder is being placed on a commerical bases in Canada & U. S. A.

Gi-Yu-Ying and Grandvoinnet prepared a chocolate from the Soya bean by adding sugar and cocoa-butter. This product has nearly the same composition appearance and tastes as chocolate.

In China the dried beans are soaked in water and roasted the product being eaten after the manner of roasted pea-nut.

Roasted beans. (Chinese).

Soak the beans for about 12 hours in a 10% solution of salt boiling slowly for about $1\frac{1}{2}$ hour and then roasting to a light brown colour. A yellow variety is better for the purpose.

CHAPTER XIX.

Indian Soya Bean Dishes.

Weights used for Indian dishes.

In India very few people make use of Metric System. There are still fewer people who can understand ounces. The standard of general weight in India is seers, tolas, and Masas. In the recipes for Indian soya bean dishes Indian weights are given so that the general public in India may understand and make use of the same.

1 masa = 1 gramme or 1/12th of a tola.
1 tola = 1 rupee weight.
40 tolas = 1 seer or pound.

Soya bean dishes in Indian style.

India is a big country where people have different climates, and have therefore different kinds of foods, dresses, languages, scripts and religions etc. We have therefore divided the preparation of soya bean dishes according to the different provincial styles in vogue. viz.

(1) The Hindustani style.
(2) The Muglai Style.
(3) The Gujarati Style.
(4) The Maharashtriyan style.
(5) The Bengali style.
(6) The Goanese style.
(7) The Tanjori style.

To make the subject simpler we have explained the methods of preparing the dishes in detail. In the beginning the materials for each preparation are given and the method is explained step by step.

(1) HINDUSTANI DISHES.

Puri.

Materials.		Seer.	Tola.	Masa.
Whole wheat flour	...	1	0	0
Soya bean flour	...	0	10	0
Ghee (shortening)	...	0	5	0
Salt	...	0	0	3
Water	...		q, s,	
Ghee	...	0	15	0

Method.

Mix the flours, add salt. Put little ghee for shortening. Prepare hard dough. Knead it soft. Take betel nut measureful from the lump and roll it flat on a circular wooden

slab. Finish the whole lump into puris accordingly. Then put a pan on fire and put ghee in it. When the ghee gets hot fry puris turning over when cooked on one side and allowing to cook the other side. Remove them in a tray and serve when cool.

Kachauri.

This preparation is made by filling in soaked soya bean pulse crushed between two stones with spices in puris while under preparation and rolling them over again. Kachauris are then fried on both sides as puri and served when cool.

Jalebi.

Materials.	Sr.	T.	M.
Thick wheat flour	0	20	0
Soya flour	0	5	0
White flour	0	12	0
Curd milk	0	5	0
Water	1	9	0
Ghee shortening	0	5	0

Method.

Mix the flours, add shortening, mix curd and warm water stirring so as to allow no thick masses to form. Keep for 24 hours in summer and 48 hours in winter.

Prepare chasni with 2 seers of sugar of one thread quality with rose water. Next day turn the lump of flour to ferment properly. Then put a pan on fire and put one seer of ghee in it. When hot, pour the fermented lump through the hole of a cocoanut shell and move the shell circularly to form Jalebis. And thus continue the process taking care to see that one piece does not over lap the other till the pan is full. Turn them over. When the completley fried Jalebis come at the top remove them to chasni when they have ceased dropping ghee. Soak them in the chasni, when ready remove to a tray and serve when cool. The chasni should be coloured with saffron before. Ghebar may also be made from this.

Gulabjambu.

Materials.		Sr.	T.	M.
Mava	...	1	0	0
Soya flour or	...	0	5	0
(Singhade flour for ekadashi days.)				
Ghee	...	1	0	0
Sugar	...	1	20	0
Rose water	...	0	5	0
Cardamom	...	0	5	0
Mace (Nutmeg covering.)	...	0	5	0

Method.

Mix mava, cardamom and mace with soya flour using rose water to make it soft, rolling the dough to round lumps of lemon size and turning them into oblong cylindrical shapes., Then fry them in ghee over slow fire. When fried red, soak them in chasni, and serve when cool.

Malpuda. (Malpuva.)

Materials.		Sr.	T.	M.
Molasses	...	0	2	0
Hot water	...	2	0	0
Soya flour	...	0	8	0
Wheat flour	...	0	22	0
Curd	...	0	2	6
Oil or Ghee	...	0	2	6
Salt	...	0	1	0
Ghee	...	0	30	0

Method.

Mix molasses in hot water. Strain through a cloth. Mix flours and put them in sweetened hot water using only half the water first. Mix curd and the remaining hot water allowing no thick masses to form in the flours. Let it stand for five hours.

Take a flat pan of one inch border and apply oil and salt to it. Wipe clean and put ghee in it. When boiling hot put in three or four lumps by a spoon and allow to spread. When cooked on one side turn gently over the next and let them cook completely. Remove to tray and finish the whole liquid mass. Serve when cool.

Malpuvas are eaten with dudhpak or pulse or currie. No almonds etc., are used in dudhpak when the same is served with malpuva.

Mohan Thar.

Materials.		Sr.	T.	M.
Gram flour	...	1	0	0
Soya flour	...	0	8	0
Ghee shortening	...	0	5	0
Milk draba	...	0	5	0
Ghee for frying	...	1	10	0
Cardamom	...	0	2	0
Mace	...	0	0	6
Saffron	...	0	0	3
Baras	...	0	0	2
Sugar	...	2	0	0
Rose Water	...	0	20	0
Silver Leaves	...	0	0	5

Method.

Mix flours add shortening and milk and keep for two hours pass through the sieve to leave no thick masses to form. Fry flours in ghee. Add spices. Boil sugar in two thread chasni adding rose water. Add 5 tolas of milk to remove dirt. When chasni is thick like honey add flours and stir. Spread in dishes half an inch thick and spread silver leaves; cut into oblong cakes when cold and then serve.

Mehsur.

Materials.		Sr.	T.	M.
Wheat flour	...	0	20	0
Gram flour	...	0	20	0
Soya flour	...	0	8	0
Ghee	...	0	15	0to fry.
Sugar	...	1	20	0
Rose-water	...	0	10	0
Milk	...	0	5	0
Ghee	...	1	20	0

Method.

Mix the flours; fry in ghee till brown. Prepare one thread chasni using milk to remove dirt. Add spices and chasni to fried flours. Add ghee after a while, ghee will rise up in the pan. Put a sieve in a tray and put in

the mixture. Take up the sieve. This leaves perforated mehsur in the dish. Collect the ghee oozing out in the dish. When drained off completely and cool, cut into oblong cakes and pile up in another tray. Serve when cool.

Shira.

Materials.		Sr.	T.	M.
Thick wheat flour	...	0	30	0
Soya flour	...	0	10	0
Ghee	...	1	0	0
Grapes	...	0	10	0
Milk or water	...	1	20	0
Sugar 1 thread chasni	...	1	0	0
Rose water	...	0	15	0
Cardamom	...	0	5	0
Almond sliced	...	0	2	0
Charoli	...	0	2	0
Pistachio	...	0	2	0

Method.

Fry the flour in ghee. Add grapes, stir them well, add milk or water; add chasni or sugar. When cooked remove the pan off the fire add spices and serve when cool.

NOTE:—If chasni is not needed take 2 seers of milk or water for the shira. Shira is eaten with puris or alone; it is used as ante-natal or post-natal light dish for the pregnant

or nursing mother throughout Indian homes. Even when people are hurt they prefer shira. Old men like shira most when they have dropped off all their teeth as it easily mixes with solid and is soft to eat.

Thor.

Materials.		Sr.	T.	M.
Thick wheat flour	...	0	10	0
Padsudi	...	0	10	0
Sesamum	...	0	1	0
Ghee	...	0	8	0
Water	...		q.	s.
Soya flour	...	0	3	0

Mix the flours, add shortening sesamum etc. padsudi is soaked, wheat kept for four hours and kneaded into dough in milk, roll into thick flat circular bhakar like cake. Fry in ghee over slow fire till brown. Soak into one thread chasni 1 seer and 10 tolas rose water. Cool down into a thick mass, remove to tray and serve when cool.

Thapadi.

Materials.		Sr.	T.	M.
Gram pulse flour	...	1	0	0
Soya flour	...	0	8	0
Ghee	...	0	5	0
Turmeric	...	0	0	3

Materials.		Sr.	T.	M.
Pepper	...	0	0	8
Asafoetida	...	0	0	2
Water or milk	...	q.		s.

Method.

Mix the flours, add shortening and knead into a dough. Roll into flat circular cakes. Fry in ghee, serve them when cool.

(2) MOGALAI DISHES.

Badam roti or Pistachio roti.

Materials.		Sr.	T.	M.
Soya milk	...	1	0	0
Sugar	...	0	10	0
Almond or pistachio	...	1	0	0
Grapes	...	0	5	0
Nisasta	...	0	5	0
Saffron	...	0	0	3
Keoda water	...	0	5	0
or				
Silver gold leaves	...	0	0	2
Cardamom	...	0	1	0

Method.

Crush the almond or pistachio and heat it. Extract oil and mix the pulp with milk and spices. Take small lumps and roll flat. Bake in an oven till it is brown, on both sides and serve when cool.

Agra Varkhi Ghari.

Materials.	Sr.	T.	M.
Soya flour	1	0	0
Ghee	1	20	0
Milk ...	1	0	0
Mava ...	0	10	0
Almond ...	0	10	0
Pistachio ...	0	10	0
Sugar ...	0	30	0
Cardamom ...	0	1	0
Gold leaves ...	0	0	6
Silver leaves ...	0	0	6
Saffron ...	0	0	2
Cochineal ...	0	0	1
Green colour ...	0	0	1
Keoda water	0	5	0

Method.

Prepare puran of different colours. Roll cakes from the dough and fill in the purans. Fry in a pan in ghee, don't fry brown. Spread gold and silver leaves over the Ghari when prepared. Rumi roti and tava puri are also made from the above materials by filling in large circular rotis and frying them as above.

Akabari Pulav.

Materials.	Sr.	T.	M.
Delhi rice ...	1	0	0
Soya pulse ...	0	2	6
Mutton ...	1	0	0

Soya Bean.

Materials.		Sr.	T.	M.
Mutton soup	...	1	0	0
Khema	...	1	0	0
Eggs	...	0	15	0
		six in number.		
Ghee	...	1	30	0
Milk	...	1	0	0
Curd	...	0	20	0
Cream	...	0	20	0
Mava	...	0	2	6
Poppy seeds	...	0	2	6
Almonds	...	0	5	0
Saffron	...	0	0	3
Otto Hina musk	...	0	0	1
Keoda water	...	0	10	0
Cardamom	...	0	1	6
Mace	...	0	0	6
Coriander	...	0	1	0
Cloves	...	0	1	0
Cinnamom	...	0	1	0
Ginger	...	0	0	2
Sages	...	0	0	2
Pepper	...	0	0	2
Variali	...	0	0	2
Soya flour	...	0	30	0
Wheat flour	...	0	20	0
Onions	...	0	20	0
Garlic	...	0	5	6
Ginger Gr:	...	0	5	0
Lemon	...	0	5	0
Mint	...	0	1	0

Materials.		Sr.	T.	M.
Silver leaves	...	0	0	1
			4 pieces.	
Gold leaves	...	0	0	1
			4 pieces.	

Method.

Fumigate meat. Fry onions lightly brown in ghee, apply garlic, ginger, coriander and salt to meat: fumigate the same with onions fried as before. Cook the eggs in the boiling water for 10 to 12 minutes. Mix eggs with fumigated meat adding lemon juice and stirring it. This is the tay.

Prepare Akhani cook gram pulse over fire and when half cooked take out the pulse by draining off the water in a tray. This is Akhani. Fumigate the Akhani, by ghee and sages. Cook rice putting in the condiments. When the rice is half cooked, make pulav as shown in the biriani process cooking the pulav to a perfection.

Biriani.

Materials.		Sr.	T.	M.
Meat	...	1	0	0
Rice	...	1	0	0
Ghee	...	0	15	0
Wheat flour	...	0	10	0

Materials.		Sr.	T.	M.
Onion	...	0	10	0
Ginger green	...	0	1	9
Coriander green	...	0	1	9
Cardamom	...	0	0	2
Cloves	...	0	0	2
Cinnamon	...	0	0	2
Pepper	...	0	0	2
Saffron	...	0	0	2
Salt	...	0	2	6

Method.

Wash the meat and cut it into slices. Add spices and fumigate meat. Cook the rice. Put the rice over Taya. Fumigate rice. Add saffron to 5 tolas rice and put it on one side in the pulav. Put rice flour mixed with water on the brink of the pan and cover lid. When it gives out steam over slow fire Pulav or Biriani is ready.

Firani.

Materials.		Sr.	T.	M.
Rice flour	...	0	5	0
Soya flour	...	0	1	0
Milk	...	1	0	0
Sugar	...	0	7	6
Water	...	0	15	0
Chhappan	...	four in number.		

Method.

Cook the rice flour in water. When it boils add milk sugar meva. Take chappans and fill in the firani. Keep it four to six hours and serve when cool.

Barfi.

Materials.		Sr.	T.	M.
Mava	...	1	0	0
Soya-milk	...	1	0	0
Sugar	...	1	20	0
Ghee	...	0	6	0
Pistachio sliced	...	0	1	0

Method

Fry mava in ghee; add water in sugar and make two thread chasani and allow it to cool. Cut into cakes after spreading it over with pistachio slices and silver leaves and serve when cool.

Italian Puff paste pyramid.

Materials.		Sr.	T.	M.
Wheat flour	...	0	30	0
Soya flour	...	0	10	0
Butterm	...	1	5	0
Lemon	...	0	3	0
Eggs	...	0	5	0

Method.

Mix the flours add shortening. Make into a thick dough. Beat with a wooden

hammer over a flat wooden slab. Spray spare flour over wooden slab and roll up again. Spread spare flour and roll up once again. Take small lumps and roll over spare flour spread over the slab. Repeat three or four times. Cut the mould into cakes keeping the roll one inch thick. Arrange the cakes into a pyramid shape putting jelley or jam round about it. Cook the whole lump into an oven and serve when cool.

Khatai Kabab.

Materials.		Sr.	T.	M.
Khema	...	1	0	0
Ginger	...	0	5	0
Salt	...	0	1	0
Coriander	...	0	2	6
Pepper	...	0	0	6
Cloves	...	0	0	3
Cardamom	...	0	0	3
Saffron	...	0	0	2
Onion	...	0	5	0
Almond	...	0	5	0
Cream	...	0	5	0
Curd	...	0	5	0
Loni	...	0	2	6
Ghee	...	0	20	0

Method.

Mix salt and ginger gr: with meat crushing them on a wooden slab. Crush all the dry spices and mix with Khema. Mix almond cream curd and loni in a lump. Fry the above in small lumps and remove to tray when fried. Serve when cool with lemon juice.

Huseni Kabab.

Materials.		Sr.	T.	M.
Meat	...	1	0	0
Ghee	...	0	20	0
Curd	...	0	10	0
Coriander	...	0	2	0
Cloves	...	0	0	2
Cinnamon	...	0	0	2
Cardamom	...	0	0	2
Chillies	...	0	0	2
Salt	...	0	1	6
Onions green	...	0	10	0
Ginger green	...	0	1	6
Garlic	...	0	0	6
Soya flour	...	0	10	0

Method.

Make small pieces of meat. Wash out. Crush the green spices and apply it to meat. Fry onion slices in Ghee, fumigate the meat. Add water and allow it to cook. Take

bamboo chips, fix meat slices intervened by onion slices. Fry the chips in Ghee. Add spices and a little water. Allow it to cook. Serve when cool. When Kababs are fried in Ghee like Bhajis they are called fried Kababs.

Dariai Kabab.

Add curd, saffron, cochineal and eggs in the above materials of huseni kababs. Colour onion slices red and yellow as a variety and the result will be Dariai Kababs.

Tikkia Kabab.

Kababs are hot to be fried but are to be roasted on bamboo chips over slow fire. The spices too are to be fumigated over the fire.

Egg Kabab.

Materials.		Sr.	T.	M.
Eggs	...	0	20	0
		twenty in number.		
Meat	...	0	5	0
Soya flour	...	0	5	0
Curd	...	0	5	0
Ghee	...	0	2	0
Salt	...	0	1	6
Almond	...	0	1	3
Coriander	...	0	1	9
Chillies	...	0	0	6
Pepper	...	0	0	2

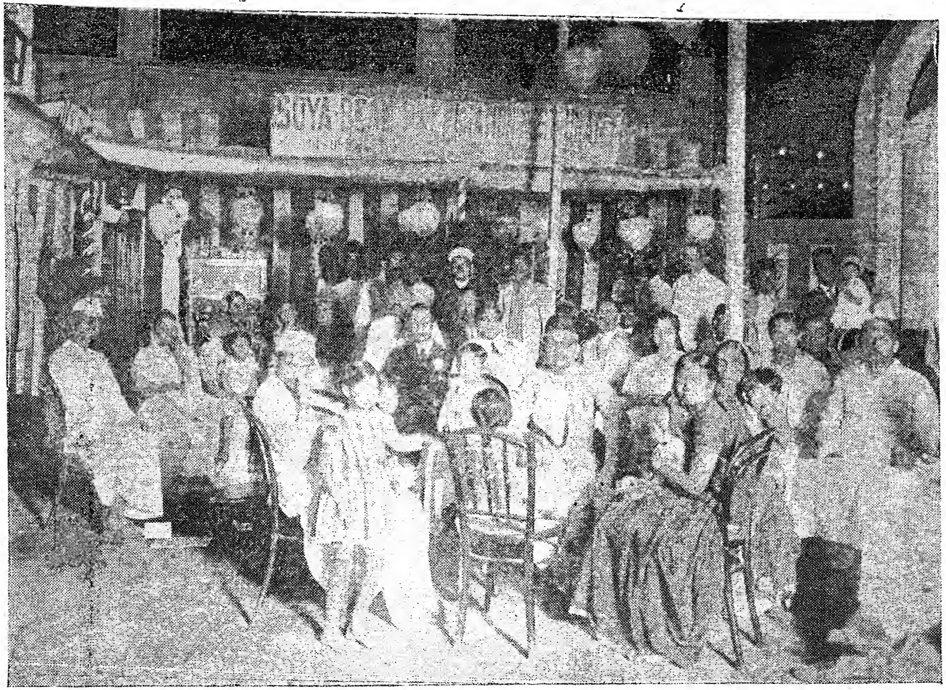
Materials.		Sr.	T.	M.
Cinnamon	...	0	0	2
Cloves	...	0	0	2
Cardamom	...	0	0	2
Ginger green	...	0	1	0
Onion	...	0	5	0

Method.

Perforate the eggs and take out the pulp, add spices and fill in the shells. Fix four lumps of flour on the top, boil the eggs. Prepare Akhani of the meat and fumigate it. Apply akhani to Kababs and roast over slow fire.

Varkhi Samosa.

Materials.		S.	T.	M.
Khema mutton or hen	...	1	0	0
Ghee	...	1	20	0
Soya flour	... ...	0	10	0
Thick wheat flour	...	0	30	0
Milk	... ...	1	0	0
Cardamom	...	0	1	0
Cloves	...	0	0	1
Pepper	... ...	0	0	3
Salt	...	0	1	6
Chillies	... ...	0	1	0
Onion	...	0	10	0
Garlic	... ...	0	1	0
Coriander green	... ...	0	5	0



The popularity of soya bean restaurant at the H. O. H. Fete Bombay.

Method.

Apply green spices, onion, garlic, ginger to meat. Cook the meat and add all the dry spices. Roll the dough made from flours with shortening into 1/5th of an inch. Divide the bread into two parts and fill in with khema making thus triangular samosa sticked together with milk or cream. Fry them in ghee or oil and serve when cool.

Pasande.

4 by 3 inches long oblong pieces of khima spiced and pierced on an iron bar and baked against fire are called Pasande by the Sikhs and are greatly relished by them.

(3) SOYABEAN DISHES GUJARATI STYLE.

Adadiyu.

This is the main tonic dish for winter. It is prepared from the following materials.

Materials.		Sr.	T.	M.
Udid pulse flour	...	1	20	0
Gram ,, ,,	...	0	30	0
Soya flour	...	1	0	0
Ghee	...	4	0	0
Almond	...	0	20	0
Cocoanut slices	...	0	5	0
Wheat milk	...	4	0	0

Soya Bean.

Materials.		Sr.	T.	M.
Lotus seed decorticated and sliced.		0	10	0
Charoli	...	0	5	0
White pepper	...	0	5	0
Safed musali	...	0	5	0
Gourd seeds	...	0	5	0
Tarbuj seeds	...	0	5	0
Nag kesar	...	0	2	0
Akalkara	...	0	2	0
Tejbal	...	0	2	0
Cinnamon	...	0	2	0
Cardamom	...	0	1	0
Mace skin	...	0	1	2
Sugar	...	12	0	0
Ginger dried	...	1	0	0
Singade	...	0	20	0
Babul gum	...	0	20	0
Pistachio	...	0	10	0
Gokharu	...	0	10	0
Khas Khas Poppy seed	...	0	10	0
Grapes dried	...	0	10	0
Pipri mul	...	0	5	0
Bal bij	...	0	5	0
Pumpkin seeds	...	0	5	0
Cucumber seeds	...	0	5	0
Surinjan	...	0	2	0
Kavach seeds	...	0	2	0
Kamarkas	...	0	2	0
Asalio	...	0	2	0
Cloves	...	0	1	0
Mace	...	0	4	0

Method.

Crush all the spices to powder. Fry them in ghee in a pan over slow fire. Fry the gum in a separate pan and crush it to powder. Fry the flours separately and mix them up when cooked light brown and sweet smelling. Prepare one thread chasani and mix all thoroughly. Spread the lump in dishes 2 inches thick and allow to cook. Cut into oblong squares to be eaten in the early morning as breakfast.

Undhiyu.

This is really an open field dish. It is prepared from the following materials.

Materials.		Sr.	T.	M.
Green soya beans	...	10	0	0
Brinjals small	...	5	0	0
Ratalu	...	2	0	0
Potatoes	...	2	0	0
Sakaria	...	2	0	0
Pepper	...	0	2	0
Sages	...	0	2	0
Salt	...	0	5	0
Ginger green	...	0	10	0
Coriander gr.	...	0	5	0
Garlic gr.	...	0	3	0
Turmeric	...	0	2	0
Cummin seeds	...	0	5	0
Till oil	...	0	10	0

Method.

Take a clay pot and fill the surface with Kalhar plants. Fill in the vegetables–Brinjals potatoes and Ratalus to be sliced into halves and filled in with crushed green and dry spices. Place Kalhar also at the top. Cover the pot with a clay lid and put it upside down. Take 20 to 30 dung cakes round the pot. Add some hay and apply fire. It will take up 45 to 60 minutes to cook. Picnic parties with sweet meats and undhiya held in the fields are very relishing.

Undhiya can also be prepared in homes in a pan on a small scale for the family and cooked over a slow fire as an evening dish.

Kansar.

This is the Gujarat marriage feast dish. It is made with the following materials.

Materials.		Sr.	T.	M.
Wheat flour	...	1	0	0
Soya flour	...	0	8	0
Sugar	...	1	10	0
Pistachio nuts	...	0	5	0
Saffron	...	0	0	5
Grapes dry	...	0	5	0
Almonds–sliced	...	0	5	0
Mace	...	0	1	0

Materials.		Sr.	T.	M.
Cardamom	...	0	1	0
Variali	...	0	1	0

Method.

The flour is to be fried brown and sweet smelling in ghee. Sugar is to be dissolved in $1\frac{1}{2}$ seer of water and added on to the flour fried brown and the whole lump is to be stirred and allowed to cook over slow fire with the lid on. Remove the fire when cooked completely and place some live coals on the lid. Kansar is otherwise called ormu. Kansar is also cooked in water alone and sweetened to taste when served with Ghee.

Lapsi dishes are also made from the above materials. Sometimes lapsi is cut into oblong cakes when cooled in dishes and served cool as a variety.

Gulgulakhas.

Materials.		Sr.	T.	M.
Wheat flour	...	0	30	0
Soya bean flour	...	0	10	0
Ghee	...	0	30	0
Sugar	...	0	30	0

Add five tolas ghee shortening to the flour. Mix the flour well. Make a semi-liquid form stirring the flour and adding sufficient water. Keep in a cool place for 45 minutes. Pour ghee in a pan and put it over fire. When heated fry small lumps turning them over when cooked on one side and then on the other side. Remove to a tray when completely cooked and serve cool.

Ganthiya.

Materials.		Sr.	T.	M.
Gram pulse flour	...	0	30	0
Soya bean flour	...	0	10	0
Salt	...	0	1	0
Cummin seed	...	0	1	0
Turmeric	...	0	0	2
Pepper	...	0	1	0
Ghee or oil	...	0	30	0
Asafoetida	...	0	0	1
Plantain stem water	...	0	10	0

Method.

Take a pan and put plantain water in it. When the water boils over fire add salt, pepper and cummin seeds crushed to powder. Mix the flour in this water and knead with a little oil. Roll the lump in thick cylindrical pencil shaped masses. Put a pan over the

fire and put Ghee or oil in it. When hot, fry the masses in it without allowing them to get brown. Serve when cool, breaking them into small pieces. Bhavanagari are best.

Ghasot.

Materials.		Sr.	T.	M.
Baked wheat flour	...	0	30	0
Baked soya flour	...	0	10	0
Sugar	...	0	20	0
Ghee	...	0	30	0
Cardamom	...	0	1	0

Method.

Bake the wheat and soya pulse and grind them into fine powder. Mix Ghee and sugar together and mix in the flours. Put cardamoms make laddus and serve.

Ghugara of dry meva.

Materials.		Sr.	T.	M.
Thick malai (cream)	...	0	10	0
Cinnamon	...	0	0	2
Pistachio sliced	...	0	5	0
Sugar ground	...	0	10	0
Rose water	...	0	2	0
Cloves	...	0	0	2
Cucumber seeds	...	0	2	0
Saffron	...	0	0	2
Cardamom	...	0	5	0
Grapes	...	0	3	0

Materials.		Sr.	T.	M.
Salt	...	0	0	3
Musk	...	0	0	½
Almond sliced	...	0	5	0
Ghee	...	1	0	0
Thick wheat flour	...	0	30	0
Soya flour	...	0	8	0

Method.

Mix saffron, musk and rose water. Grind cinnamon, cloves and cardamom to powders. Fry cucumber seeds, pistachio and almond slices in ghee until light brown. Mix sugar and grapes. Knead the wheat flour into a dough mixing ghee and salt as shortening. Take small lumps and roll into flat circular shapes and fill in with creamed puran prepared as before. Turn into Ghugaras and allow to dry in a cool place Fry in oil and serve when cool.

Variety of pungent and sweet ghugaras by altering the purans and even Kachauris of Hindustani style can be made accordingly.

Ghari (pungent).

Materials.		Sr.	T.	M.
Soya bean pulse	...	1	0	0
Salt	...	0	2	0
Turmeric	...	0	1	0

Materials.		Sr.	T.	M.
Ginger green	...	0	2	0
Oil	... ...	0	30	0
Chillies	...	0	2	0
Asafoetida	...	0	0	2
Coriander	... ...	0	2	0
Green chillies	...	0	5	0
Wheat flour	...	0	10	0

Method.

Soak soya pulse overnight aud drain it off in the morning. Wash it again and drain off water. Crush it with the spices between two stones; this is the puran.

Prepare flat circular shapes from the kneaded dough of the wheat flour. Fill in the puran and roll up into small flat circular masses. Fry them in oil or ghee and serve when cool.

Dhoklas.

Materials.		Sr.	T.	M.
Soya Bean pulse	...	0	30	0
Udid pulse	...	1	10	0
Rice	...	0	20	0
Ginger Gr:	...	0	2	0
Chillies Gr:	...	0	5	0
Coriander Gr:	...	0	5	0
Oil	...	1	0	0
Salt	...	0	1	0

Materials.		Sr.	T.	M.
Chillies powdered	...	0	5	0
Coriander crushed	...	0	5	0
Sages	...	0	1	0
Paper crushed	...	0	1	0
Cocoanut sliced.	...	0	20	0

Method.

Mix the pulses together in a tray or crush the pulses and spices together between two stones. Put in all the spices using hot water for the mixture. Let it stand for 24 hours in summer and 48 hours in winter. Put a pan wide enough to contain trays. Put a sieve in it upside down and fill in water upto the sieve. Apply heat and when the water boils spread the lump in trays and put them in the pan allowing the steam to cook them. Oil should be smeared to the trays before putting in the lump. When cooked, remove the tray and put another in its place. When slightly cool cut oblong dhoklas spreading coconut slices over them. Serve them with Ghee, Oil, Shrikhand, Mango juice or Murabbas.

Some people fumigate Dhoklas with oil and mustard and eat them with chutneys as a relishing pungent dish. Dhoklas are a

light nourishing treat and they are exchanged in Gujarati homes for their excellence as a variety treat.

Dahitaras.

Materials.		Sr.	T.	M.
Thick wheat flour	...	1	0	0
Soya flour	...	0	20	0
Ghee	...	0	30	0
Rice flour	...	0	20	0
Milk	...	0	20	0

Method.

Mix the flours thoroughly, add shortening 10 tolas ghee. Make a hard kneaded dough. Hammer it soft. Let it stand in shade for two hours. Roll into thick flat circular shapes. Put a pan over slow fire and put ghee into it. Fry but don't allow the dahitras to get brown. Serve when cool.

Soya bean Shev dudhpak.

Materials.		Sr.	T.	M.
Milk	...	10	0	0
Sugar	...	1	20	0
Cardamom	...	0	1	0
Mace	...	0	0	3
Soya Shev dried	...	0	20	0
Almond sliced	...	0	5	0
Pistachio sliced	...	0	5	0
Ghee	...	0	5	0

Method.

Boil the milk. Break up the shev and fry it in ghee not allowing it to get brown. Add it to the boiling milk. When thick, add sugar and spices and take off. Serve when cool.

Soya bean Osaman.

Take water from soya pulse boiled and drained through a sieve left over from Puranpoli or Kachauri. Add the following.

Materials.		Sr.	T.	M.
Salt	...	0	1	0
Turmeric	...	0	0	6
Lemon or tamarind	...	0	1	0
Chillies	...	0	0	5
Coriander Gr:	...	0	2	0
Coconut sliced	...	0	1	0
Molasses	...	0	2	0
Sages	...	0	0	3
Ghee to fumigate	...	0	1	0

Method.

Add the spices to the water, boil and stir. Fumigate and serve when cool.

Bhakari.

Materials.		Sr.	T.	M.
Wheat flour	...	1	0	0
Soya fiour	...	0	8	0
Ghee	...	0	2	0

Materials.		Sr.	T.	M.
Turmeric	...	0	0	3
Salt	...	0	0	5
Ginger Gr:	...	0	0	5
Chillies	...	0	0	5
Curd	...	0	1	0
Asafoetida	...	0	0	2
Ghee	...	0	10	0

Method.

Mix the flours; add shortening, add spices, knead the flour into a hard dough. Take small lumps and roll into small flat circular shapes. Fry in Ghee in a flat pan. When cooked on one side turn over and add Ghee to cook on the other side. When completely cooked place in a separate tray. Serve when cool.

Soya Bean cakes.

Materials.		Sr.	T.	M.
Soya flour	...	1	0	0
Ghee for shortening	...	0	5	0
Milk draba (keep for 2 hrs)	...	0	5	0
Ghee for frying	...	1	0	0
Sugar	...	1	10	0
Cardamom	...	0	0	3
Ghee to spread (over cakes)		0	15	0
Almond	...	0	5	0
Pistachio	...	0	5	0
Charoli	...	0	5	0

Method.

Mix the flours in Ghee and milk. Fry in Ghee till light brown and sweet smelling; add sugar and cardamom. Spread in dishes to the thickness of $\frac{3}{4}$th of an inch, spread almonds, charoli and pistachio slices; pour Ghee to spread over and allow to freeze. 12 hours cooking is enough. Cut into oblong shapes and serve or spread gold and silver leaves over the cakes and then serve.

Note :—If the flour used has any thick mass pass it through a sieve and it will disappear.

Raseli.

This is field dish where sugarcane juice is extracted for the manufacture of jaggery or sugar. It is a very nice morning or evening treat.

Materials.		Sr.	T.	M.
Sugarcane juice	...	5	0	0
Milk [illegible]	...	0	5	0
Rice flour	...	1	0	0
Soya flour	...	0	10	0
Cardamom	...	0	0	5
Mace	...	0	0	3
Ghee	...	0	15	0

Method.

Fry the flours in ghee. Boil the cane juice and add milk to it to remove the dark colour, remove it when coming to the top. Add fried flours and spices; stir till the material is thick like shrikhand. Spread some ghee in the dish and pour mass till half inch thick. Allow it to cool; and when forzen cut into cakes and serve.

Dudheli.

This is a home-dish of Rasoli type. It is made from the following materials.

Materials.		Sr.	T.	M.
Rice flour	...	1	0	0
Soya flour	...	0	8	0
Milk	...	5	0	0
Sugar	...	1	20	0
Cardamom	...	0	1	0
Mace	...	0	0	3
Charoli	...	0	1	0
Pistachio	...	0	1	0
Ghee	...	0	15	0

Method.

Fry the flours in ghee. Put a pan over fire and boil milk. Add flours and spices. Stir on till whole mass becomes thick and then spread in dishes smeared

with Ghee. Spread charoli and pistachio slices. When dry cut into cakes and serve.

Sutarpheni.

This is a famous Cambay dish and a speciality there for years. It is made from the following materials.

Materials.		Sr.	T.	M.
Sugar	...	5	0	0
Ghee	...	4	0	0
Wheat flour	...	2	0	0
Rice flour	...	2	0	0
Soya flour	...	0	20	0
Pistachio	...	0	1	0
Charoli	...	0	1	0
Rose water	...	0	30	0
Cardamom	...	0	1	0
Salt	...	0	0	3
Oil			q.	s.

Method.

Mix the flours of wheat and soya with water into a dough and cover with wet malmal. Repeat kneading after next two hours making dough more soft. Thrash it with a stone slab like washing of a cloth. Stretch it till threads come out repeating the thrashing process. Beat and thrash and roll it. Take small lemon sized lumps taking oil at every

touching. Make the lump into long ganthias. Stretch them as long as possible. Spread oil over a wooden slab 5 ft. long and 2 ft. broad. Fix the two ends of the long lumps at one end of the slab breadthwise and cover with wet malmal. Spread oil over the long lumps and cover them with wet malmal. Take the rice flour mixed with ghee and spread it over all the lumps; roll up the long lumps into round lumps and cover with wet malmal. After 20 minutes spread the round lumps lengthwise; apply oil and cover with wet malmal. Take the lumps at one end stretch out like rope and cover with wet cloth, when collected on one side. Repeat till the roll becomes thinner and thinner each time till at last it becomes as thin as thread. Roll them over two fingers till the mass becomes the exact size of sutarfeni desired fixing the other end in the middle. Allow no thread to go zigzag, otherwise it spoils the pheni. Spread oil on the wooden slab and put phenis thereon. If you require small then 1/2 inch size and if large then one inch size phenis should be perpared. Fry in Ghee allowing not to fry brown. Don't turn over

but go on pouring hot oil over feni by frying spoon. When fried completely remove and soak in Chasani. Even there pour chasani over it with a spoon, don't disturb, take them gently. If kesari feni is required prepare kesari chasani. Sprinkle charoli, cardamom and pistachio slices on phenis. Chasani should be prepared in rose water. Serve next day when cool. Sutarfeni is also eaten with milk as a relish..

Tapeli.

Materials.		Sr.	T.	M.
Gram pulse	...	0	10	0
Soya pulse	...	0	10	0
Rice	...	0	10	0
Salt	...	0	1	0
Turmeric	...	0	0	3
Ginger .	...	0	1	0
Chillies	...	0	1	0
Asafoetida	...	0	0	2
Whey	...	2	0	0
Oil	...	0	1	0

Method.

Fumigate the pan in oil and asafoetida. Add flours, spices in whey and stir allowing no thick masses to form. Put in the mixture over slow fire. When cooked take out the

whole lump and cut in slices in a tray. Serve when slightly cooled and eat with oil.

This dish is as tasty as dhokla and is eaten with relish as evening dish in Gujarati homes.

(4) MAHARASHTRIAN DISHES.

Usul.

Materials.		Tolas.
Oil	...	5
Salt	...	2½
Opion	...	10
Coconut Kernal	...	10
Garlic	...	2½
Cummin seed	...	1/4
Asafoetida	...	1/8
Turmeric	...	1/8
Spices powdered	...	2

Make the sprouts as explained before. Clean the sprouts with cold water and put them in a cool place. Place the pan on fire. Pour the oil in the pan and let it boil. Add sliced onions, garlic and asafoetida. Mix soya bean sprouts with powdered spices and put them in the pan, and allow them to be cooked on slow fire. When half cooked, add salt and turmeric and stir it well with a spoon and close the lid. Allow it to cook

completely over slow fire. After it is well cooked serve this slightly hot.

Besan Pithle or Zunka.

Materials.		Sr.	T.	M.
Soya bean flour	...	0	20	0
Gram flour	...	0	20	0
Onions	...	0	10	0
Pepper	...	0	0	2
Sages	...	0	0	2
Asafoetida	...	0	0	1
Cocoanut kernal	...	0	3	0
Turmeric	...	0	0	3
Salt	...	0	2	0
Coriander (Green.)	...	0	2	0
Chillies powder	...	0	1	0
Oil	...	0	5	0
Water	...	0	30	0

Method.

Put the pan containing oil on fire. When the oil is hot put sliced opions and fry them until brown in colour. Put pepper powder, sages, chillies and turmeric into the pan, stirring a little; add water. When it boils add soya bean flour and gram flour bit by bit turning the mass with a spoon. So that nodules may not be formed. When all the flour is over close the pan and allow it to cook. Later put cocoanut kernel and

coriander in it. Let it again cook. If you wish to serve it thick, evaporate water; if you wish to serve it in more liquid form do not dry up watery portion.

Thick Besan is prepared from pulse of soya bean. Soak soya beans at night in water. Drain off the water in the morning. Wash the beans with clean water. Remove the skin and crush or grind the pulse between the stones and prepare the dish as shown above. Groundnut, peanut, alans and zunka may be treated accordingly.

Patvadi.

Materials.		Sr.	T.	M.
Soya bean flour	...	0	20	0
Cocoanut kernal	...	0	10	0
Water	...	0	20	0
Oil	...	0	5	0
Khaskhas	...	0	5	0
Salt powdered	...	0	1	0
Turmeric	...	0	0	3
Coriander	...	0	1	0
Asafoetida	...	0	0	½
Coriander (Green)	...	0	1	0
Cloves	...	0	0	½
Chillies	...	0	1	0
Pepper	...	0	0	2
Garlic	...	0	1	0

Method.

Put the pan containing oil on fire. When it is hot, put in dry spices and fry a while. Crush green spices. Boil the water in another pan. While boiling put all the above things in it. Put the soya bean flour in it, stirring it well. Cover the lid and let it be cooked. Take a flat vessel and spread a little oil on it and put the whole lump of the cooked material in it, and spread the lump of the material cooked to a thickness of ¼ inch. Take a wet cloth and squeeze out water and spread it over the flat vessel containing the lump. After some time take away the cloth and spread powdery bits of cocoanut and Khaskhas on the lump. Press it gently, allowing it to cool and cut out the lump in oblong pieces with a knife. This dish is served when cool. Kothimbir vadi can be prepared in the same way only with the addition of the coriander in a greater quantity than above.

Bakar Vadi.

Materials.		Sr.	T.	M.
Wheat flour	...	0	20	0
Soya bean flour	...	0	20	0
Dry chillies	...	0	1	0

Materials.		Sr.	T.	M.
Coriander	...	0	0	3
Pepper	...	0	0	3
Cocoanut kernal	...	0	1	0
Asafoetida	...	0	0	1
Turmeric	...	0	0	3
Salt	...	0	2	0
Garlic	...	0	0	6
Coriander green	...	0	0	1
To be mixed in Bakar.				
(Til.) Sesumum seeds	...	0	10	0
Cocoanut kernal	...	0	10	0
Cloves	...	0	0	6
Pepper	...	0	1	0
Sages	...	0	0	6
Dalchini	...	0	1	0
Asafoetida	...	0	0	2
Khaskhas	...	0	5	0
Ginger green crushed	...	0	0	6
Garlic green ,,	...	0	0	6
Salt powdered ,,	...	0	1	0
Ghee	...	0	30	0

Method.

Make the flour in to a dough with water. Fry tilseed and cocoanut kernal for a while in oil and mix it with Bakar. Add green spices to bakar. Spread the dough into rolls of uniform breadth and thickness. Spread bakar on rolls and press gently. Thus fill

in bakar with the whole dough rolls and close it up. Place all these rolls in an oven and allow them to be cooked on slow fire. Cut them out into circular cakes and fry them in a frying pan. It is a hot as well as a cold dish. It keeps well for a week.

Soya bean leaves as Patal Bhaji. (Leafy liquid vegetable).

Materials.		Sr.	T.	M.
Soya bean leaves green	...	0	40	0
Groundnut seeds	...	0	5	0
Soya bean seeds green or sprouted	...	0	5	0
Tamarind	...	0	5	0
Molasses	...	0	2	0
Soya bean flour	...	0	2	0
Asafoetida	...	0	0	1
Chillies powdered	...	0	1	0
Salt ,,	...	0	2	0
Cocoanut kernal	...	0	2	6
Oil	...	0	2	6
Rye (Mustard)	...	0	0	2
Garlic	...	0	1	0

Method.

Slice soya bean leaves and cook them in a pan containing $1\frac{1}{2}$ lb. water on slow fire. When half cooked ground nut seeds, soya bean seeds, either green or sprouted to be

added and allowed to cook well. When the seeds are half cooked, add tamarind, molasses and soya flour made into a thick jelley with water. Add crushed cocoanut when the vegetable is cooked; mix garlic fried in oil in a separate frying pan. Serve it slightly hot.

Alu Vadya.

Materials.		Sr.	T.	M.
Soya flour	...	0	20	0
Chillies crushed	...	0	1	0
Salt powdered	...	0	1	0
Pepper	...	0	1	0
Sages powdered	...	0	0	3
Coriander green	...	0	1	0
Garlic crushed	...	0	0	6
Coriander dry (powdered).		0	1	0
Cocoanut (powdered)	...	0	0	6
Turmeric (powdered)	...	0	0	6
Tamarind	...	0	2	0
Oil	...	0	20	0
Alu leaves (green)	...	0	20	0
Water	...	0	10	0
Wheat flour	...	0	2	6

Method.

Crush the spices and mix it with water in which tamarind is dissolved. Clean Alu leaves with a piece of cloth. Mix soya flour with the spiced water and then apply that flour to the

leaves on the other side. Put another alu leaf over the one smeared over with wet flour. Roll up both the leaves and place all these rolls in a pot half filled with grass and $\frac{1}{4}$ filled with water. Then keep it over fire to cook. When cooked the rolls may be cut into circular cakes and fried in oil. Serve when cool.

Soya bean Bhajis.

Materials.		Sr.	T.	M.
Soya bean flour	...	0	20	0
Oil	...	0	15	0
Sages	...	0	0	2
Water	...	0	10	0
Turmeric	...	0	0	3
Chillies (powdered)	...	0	0	6
Asafoetida	...	0	0	1
Garlic	...	0	0	4
Pepper	...	0	0	3
Coriander (green crushed).		0	0	4
Salt	...	0	0	6

Method.

Add one tola oil for shortening the flour and then add spices. Mix water to make a liquid pasty form. Allow the mixture to stand for one hour. Place the frying pan containing oil over the fire and when it is hot put in flour of the size of a nut one by one.

When the pan is full of sufficient Bhajis and they get half fried on one side turn them over again. When Bhajis get brown in colour take them out and place them in a tray. Allow them to cool and serve.

NOTE :—Onion, Brinjal, Potato, methi, poi, pepermint, green chillies, coriander, cumin leaves green can be used as a variety and soaked in this flour as above to make different kinds of Bhajis; also plaintains, ratalu and other vegetables can be used to make soya bean flour Bhajis.

Vadas of Soya bean pulse.

Materials.		Sr.	T.	M.
Soya bean pulse	...	0	40	0
Chillies powdered	...	0	1	0
Coriander ,,	...	0	0	6
Turmeric ,,	...	0	0	3
Sages ,,	...	0	0	3
Pepper ,,	...	0	0	3
Garlic crushed	...	0	0	6
Asafoetida (powdered)	...	0	0	1
Coriander (green crushed)	...	0	0	6
Salt (powdered)	...	0	2	0
Water (to soak pulse)	...	2	0	0
Oil	...	0	20	0

Method.

Soak the pulse in two seers of water overnight and wash the pulse clean twice next morning. Crush the pulse into a thick mass and add spices. Put the pan containing oil over fire when it is hot put in the vadas made on a piece of wet cloth and fry them one by one, turning them on both sides. When they get brown in colour take the vadas out with a frying spoon and put them in a tray. Serve them when cool. These vadas are eaten with curd milk after soaking them in it, for an hour or so. They are much relished.

Vade. Konkani style.

Materials.		Sr.	T.	M.
Oil or ghee	...	1	0	0
Rice	...	0	10	0
Wheat	...	1	0	0
Soya pulse	...	0	10	0
Udid	...	0	10	0
Methi	...	0	3	0
Turmeric	...	0	0	6
Salt	...	0	2	6

Method.

Wash rice with water. Drain off the water. Spread rice on a clean cloth and

allow it to dry in shade. Boil the rice with little water keeping it semi-liquid. Grind the remaining ingredients and mix them properly with the boiled liquid rice. When properly mixed put in a vessel fumigated as follows.

Take a live charcoal and put a little ghee on it. When it fumigates in the vessel cover it with the lid and let it remain. Put the whole lump in the same vessel for twelve hours. Next morning take small lumps and make circular vadas making a small hole in the centre and fry in a frying pan hot with oil. Serve them warm.

Mung vada.

Materials.			S.r	T.	M.
Mung pulse		...	0	30	0
Soya pulse		...	0	10	0
Dry chillies (powdered)		...	0	1	0
Coriander	,,	...	0	0	6
Turmeric	,,	...	0	0	3
Pepper	,,	...	0	0	3
Sages	,,	...	0	0	3
Garlic (crushed)		...	0	0	6
Asafoetida		...	0	0	1
Salt		...	0	2	0
Water		...	2	0	0
Coriander Gr:		...	0	2	6

Method.

Soak mung and soya pulse in water at night. In the morning, drain the water. Wash with clean water three times. Crush all the spices and mix them with the pulse. Crush all into a lump.

2. Fumigating the curd keep a pan on fire. Pour little ghee in it. When it is warm put in garlic and asafoetida. When it gets brown put it into the curd.

Materials.		Sr.	T.	M.
Curd	...	2	0	0
Garlic	...	0	0	6
Asafoetida	...	0	0	1
Ghee	...	0	20	0

Fry vadas and put them into the curd. Serve when cool. Dal Vadas Suran Vadas, Green soya bean seed vadas may also be made according to the above process. Kadbolas may be prepared in the same way. Only roll the lump like Jalebi and fry in ghee or oil. Undya may be prepared accordingly if the lump is cut in square pieces.

Dhirde.

Materials.		Sr.	T.	M.
Rice	...	0	20	0
Udad pulse	...	0	10	0

Soya Bean.

Materials.		Sr.	T.	M.
Soya pulse	...	0	10	0
Salt	...	0	2	6
Coriander green	...	0	2	6
Asafoetida	...	0	0	1
Oil	...	0	10	2

Method.

1. Soak in water the pulses and rice at night. In the morning clean it with water. Crush it in grinding stones. Put a little curd into it. Add green crushed spices and mix them thoroughly.

2. Put a flat pan on the oven and heat it slowly. Smear the pan with oil using cloth wet with oil. Put the semi-liquid material in the pan and spread it evenly in a circular form and cover it. Turn it when cooked on one side. Allow it to cook on the other side and remove them to the tray.

Ghavane may be prepared in the same way by adding rice flour and cocoanut milk. It is eaten with milk and sugar.

Ghavane is not a pungent dish. Sandane is prepared in the same way adding rice and udad flour but to be boiled over steam. When cooked it is eaten with milk and sugar.

Papadya.

Materials.		Sr.	T.	M.
Rice	...	1	0	0
Soya pulse	...	0	10	0
Salt	...	0	4	0
Khaskhas	...	0	5	0
Alum	...	0	0	6
Water	...	4	0	0
Oil	...	0	2	6

Method.

Soak in water rice and soya pulse in 3 seers of water for 24 hours. Drain the water next day. Crush them between stones. Add 4 srs. water and filter it through a cloth, then add powdered salt. Put the whole semi-liquid over fire and cover the pan with a lid. When steam comes out understand that it is cooked. Take another pan and cover its mouth with a cloth. When steam comes out take a banyan leaf and take the semi-liquid on the leaf and allow it to spread. Put the leaf over the boiling water on the cloth. Allow it to stand for a minute covering it with a lid. When it is cooked remove it and dry it on a cloth in the sun. This is eaten either fried or baked over fire. Serve it when cool.

Papad.

Materials.		Sr.	T.	M.
Udid pulse	...	1	20	0
Soya pulse	...	0	20	0
Sages	...	0	1	0
Pepper	...	0	0	6
Asafoetida	...	0	0	4
Papad khar	...	0	0	6
Salt	...	0	3	0
Water	...	0	30	0
Plantain stem juice	...	0	20	0
Whey	...	0	10	0
Oil	...	0	2	6

Method.

Crush the spices to powder. Grind the pluses and mix the flour with the spices into liquids to make lump. Cover with a plantain leaf and allow it to stand for one night. Beat the lump soft with hammer on a wooden plank. Take the lump in the size of a betel nut. Roll it into circular thin shape on a brass plate turned upside down, using oil in the process. Dry it in sunlight. Fry one by one in heated oil ready in a frying pan. Serve it hot. Papad can also be served baked over fire instead of frying them in oil.

Kurdaya.

Materials.		Sr.	T.	M.
Wheat	...	4	0	0
Soya bean	...	1	0	0
Water	...	12	0	0
Salt	...	0	15	0
Sages	...	0	2	6
Oil	...	0	10	0

Method.

Soak in water wheat and soya bean for six days. On the 7th day take out water and crush it between stones and put it in a pan, after filtering through cloth. Cover the lid and allow it to stand it for a day. Next morning add salt and sages. Put the pan on fire and stir with a wooden rod. When it is boiled, remove the fire. When the pulp is hot put it in Kurdaya instrument and press it. Collect Kurdaya which fall through and dry them in the sun. Some people prepare Kurdaya with rice flour in the same way. They should be fried in ghee or oil and served cool.

Shevaya.

Materials.		Sr.	T.	M.
Thick wheat flour	...	1	0	0
Ghee	...	0	5	0

Materials.		Sr.	T.	M.
Soya flour	...	0	10	0
Milk	...	1	0	0
Salt	...	0	0	6

Method.

Take flour, a little ghee and salt and mix them up. Add milk and knead it properly. Keep it for one hour. Hammer the lump soft on a wooden slab, and cover with a cloth. Straighten the lump horizontally in hands. When it gets soft put it in the instrument and press when threads will come out. Dry them in the sun, it is cooked in boiling water. When it is cooked eat it with milk and sugar. ...

Botway is prepared in the same way. It is not made into threads but in small pieces of $\frac{1}{4}$th inch. Nakhole is done with pinch and nails.

Varan.

Materials.		Sr.	T.	M.
Water	...	3	0	0
Soya pulses	...	1	0	0
Ghee	...	0	2	6
Turmeric	...	0	0	4
Asafoetida	...	0	0	$\frac{1}{2}$
Salt	...	0	2	0

Method.

Wash in water soya pulse twice and apply ghee with both hands, to the pulse after water is drained out, put it in a pan containing boiling water. When it gets soft crush it between stones, and add spices and allow it to take semi-liquid shape in the boiling water. Stir it till it forms a thick lump. Serve when cool.

Pungent Varan can be prepared with the following materials added.

Chillies	...	0	1	0
Garlic	...	0	0	5
Pepper	...	0	0	2
Cloves	...	0	0	1
Taj	...	0	0	3
Sages	...	0	0	3
Coriander green (crushed)	...	0	0	6
Fumigated with ghee	...	0	2	0
Garlic	...	0	0	1
Asafoetida	...	0	0	½

Chola, wal, math, udad, mung, peanut, lang, masur, gram and other pulses may be mixed with soya bean pulses to make pungent Varans of varieties as shown above.

Kanchan soup is made with sirasis oil 2½ tola for shortening.

Sambare.

Materials.		Sr.	T.	M.
Curd	...	1	0	0
Green chillies	...	0	1	0
Sages	...	0	0	6
Turmeric (powdered)	...	0	0	3
Green coriander	...	0	2	0
Asafoetida	...	0	0	1
Cocoanut	...	0	1	0
Garlic	...	0	0	6
Soya flour	...	0	5	0
Green ginger	...	0	2	6
Ghee (for fumigation)	...	0	5	0
Sages	...	0	0	1
Rye (Mustard)	...	0	0	2
Asafoetida	...	0	0	1

Method.

Mix soya flour in sweet curd slowly to avoid forming thick masses. Add spices, fumigate the curd and cover with lid.

Some other kinds of sambares.

Materials.		Sr.	T.	M.
Salt	...	0	3	0
Water	...	2	0	0
Cucumber	...	1	0	0
Sugar	...	0	2	6

Method.

Add boiling water to curd. Allow it to boil 4 or 5 times. Cut cucumber pieces in groundnut shape removing seeds if any. Put them in the boiling curd. Allow to boil twice, to get the cucumber cooked thoroughly. Add salt. Take off the pan. Allow it to cool and serve. Red bhopala, padval and other vegetables are put into sambara as a variety in taste.

Kadhi.

Materials.		Sr.	T.	M.
Whey	...	2	0	0
Green chillies	...	0	1	0
Salt	...	0	2	0
Sages	...	0	0	6
Turmeric	...	0	0	3
Green coriander	...	0	2	0
Asafoetida	...	0	0	1
Cocoanut (crushed)	...	0	1	0
Garlic (crushed)	...	0	0	6
Soya flour	...	0	4	0
Ghee	...	0	2	0
Asafoetida	...	0	0	1
Rye (Mustard)	...	0	0	2
Sages	...	0	0	1
Sweet nimb	...	0	0	1

Method.

Put the whey in a pan; add spices and spread slowly the soya flour. Fry the spices in ghee. When smoke issues cover with a lid. Add whey shortly after this. Cover lid. Put the pan over the fire. Allow it to boil twice and take pan off the fire. Serve it hot.

Amti.

Materials.		Sr.	T.	M.
Soya beans pulse	...	0	20	0
Ghee	...	0	2	6
Water	...	1	0	0
Coriander	...	0	0	6
Cocoanut	...	0	1	6
Chillies	...	0	0	9
Pepper	...	0	0	1
Cloves	...	0	0	1
Sages	...	0	0	1
Dalchini	...	0	0	2
Elaichi	...	0	0	1
Coriander (green)	...	0	2	6
Turmeric	...	0	0	3
Asafoetida	...	0	0	1
Salt	...	0	1	6
Garlic	...	0	0	3
Hot water	...	1	0	0
Oil (fumigation)	...	0	5	0
Garlic	...	0	0	9
Coriander	...	0	0	6

Method.

Take a pan containing water and boil it on fire. Add soya pulses. Crush all the spices and add the same when the pulse is half cooked after being crushed between stones. Allow it to cook completely. Then take another pan to fumigate the amti when the garlic gets red in the ghee. Add molasses and tamarind to taste. Serve it hot. Mung amti also can be made in the same way.

Khichadi. (Masaledar-spiced).

Materials.	S.	T.	M.
Green sprouts (Soya bean).	0	20	0
Rice ...	1	0	0
Onion ...	0	10	0
Coconut milk ...	0	5	0
Ghee ...	0	10	0
Cardamum ...	0	0	6
Cinamum ...	0	0	6
Cloves ...	0	0	3
Turmeric ...	0	0	3
Salt ...	0	1	6
Sages ...	0	0	2
Coriander ...	0	2	0
Green chillies ...	0	2	0
Water ...	2	0	0

Method.

Clean sprouts and rice in water, rub them and drain off the water. Put a pan

containing ghee on fire. When it is warm put sliced onions and fry them brown. Put the rice in it. Clean sprouts and put in the rice. Cardemoms, cloves and crushed nuts may be added. Crush the dry spices to powder and add water allowing it to be cooked, stirring it before putting the lid on. Add water if it has evaporated before the Khichadi is cooked.

When it is cooked add ghee, coriander green and cover the lid. Remove fire and allow it to cook on slow fire putting some live coals on the lid. Serve it warm.

Tasty dishes of green and tender soya beans are made as above. Kabuli Khichadi, Himut pasand Khichadi, Mahmadi Khichadi can be prepared as above.

Khichadi

Materials.		S.	T.	M.
Soya bean pulse	...	0	15	0
Rice	...	0	20	0
Ghee	...	0	2	6
Turmeric	...	0	0	3
Salt	...	0	1	0
Water	...	2	0	0

Method.

Mix pulse and rice and clean it with cold water. Rub them properly while cleaning. Let the water be drained Put two pounds of water for boiling. When at the boiling point put the cleaned pulse and rice into it. Add the spices and let it be cooked, putting the lid on. If the water has evaporated put a little more water if needed. Add ghee and let it be properly cooked on slow fire. Put some fire on the lid also.

Soya bean Bhat Masaledar. (Spiced).

Materials.		S.	T.	M.
Delhi rice	...	0	20	0
Soya sprouts	...	0	20	0
Cinamum	...	0	0	3
Cloves	...	0	0	9
Sages	...	0	0	9
Pepper	...	0	0	9
Turmeric	...	0	0	9
Cocoanut kernal	...	0	3	0
Chillies green (crushed)	...	0	2	0
Coriander	...	0	1	0
Ghee	...	0	15	0

Method.

Clean rice with water. Clean the sprouts and mix them with rice. Crush the spices

and mix it properly. Put a pan containing ghee on fire. When it is hot put rice and sprouts stirring the whole up with a spoon. Add 30 tolas water and allow it cook, covering the lid on and adding more water if needed. Add the following:—

Caju nuts	...	0	5	0
Raisins	...	0	5	0
Cardamum	...	0	0	6
Cinamum	...	0	0	3
Cream	...	0	5	0

Put salt and cover the lid. When cooked add ghee 5 tolas and saffron 2 masas. Rose water 5 tolas. Put some coal on the lid and keep it on slow fire till completely cooked. Serve it hot.

Spiced rice of other varieties can be made using potatoes, green peas, annanas and other fruits as well in the manner shown above. Sugar is also added to taste.

Roti, Chapati and Polies.

This is the food for millions in India. Wheat is deficient in fat, mineral salts and suitable vitamins. It is deficient in chlorine. Addition of soya been flour therefore, enhances

the nutritive value of the wheat flour. It is recommended to add 15% to 25% of soya bean flour to make up the above deficiency.

Materials.		S.	T.	M.
Whole wheat flour	...	1	0	0
Soya bean flour	...	0	10	0
Oil or ghee	...	0	2	0
Water	...	0	30	0
Salt	...	0	0	6

Method.

Take wheat flour and mix it with soya flour. Put a little oil or ghee and mix it with the flour as shortening. Then add water mixed with salt and make it into a dough. When formed into a lump, knead it to make it soft. Take a small lump and make it into a circular shape on a wooden circular slab using a wooden roller. Then put it on a flat pan on slow fire and turn it on the other side when half cooked. When it is cooked on both sides put it on a coal fire and allow it to roast. Then take it out and apply ghee and put them one above the other.

Pandhari poli (white flour poli) is made from white flour by the same process as described above. Ghadichi Poli (folded poli)

is made as above but at the time of preparing it smear little oil folding the lump and rolling it.

Puran poli, sanjachi poli will be treated under sweets Puran and sanja are put under the lump and then rolled.

Chutney (soya bean).

Materials.		Sr.	T.	M.
Soya pulse	...	0	10	0
Coconut kernal	...	0	5	0
Coriander green	...	0	0	2
Chillies ,,	...	0	0	2
Ginger ,,	...	0	0	2
Mint leaves green	...	0	0	1
Kadhinimb leaves	...	0	0	1
Salt	...	0	0	3

Method.

Soak in water soya been pulse at night. In the morning drain the water and wash it with clean water twice. Crush it under stones along with spices. Add lemon juice to taste. Variety of chutneys can be made with raisins, dates and other ingredients added to taste.

Soya bean chutney.

Materials.		Sr.	T.	M.
Soya pulse	...	0	20	0
Coconut dry	...	0	10	0

Materials.		Sr.	T.	M.
Oil	...	0	20	0
Chillies (powdered)	...	0	0	3
Turmeric	...	0	0	2
Salt	...	0	0	5
Coriander	...	0	0	3
Sesamum seeds	...	0	1	0

Soak in water soya pulse. After three hours drain the water and spread it on a piece of cloth. Put the pan containing oil on fire and make it hot. Put soya pulse little by little. It will come up on the oil. Take it out and put it in a seive to drain the oil. Rub the coconut in small sticks and fry it in oil. Take it out immediately. Put all the spices except salt and chillies and mix all together, Put chillies, salt and turmeric and mix them well.

Other dry chutneys can be prepared from other pulses mixed with soya bean pulse as above.

Purnan poli.

Materials.		Sr.	T.	M.
Wheat flour	...	1	0	0
Soya flour	...	0	10	0
Ghee	...	0	5	0
Water	...	1	0	0

Method.

1. Mix soya flour with wheat flour. Add ghee as shortening. Add water and make it into a dough kneading into a shoft mass. Cover with a wet cloth.

FOR PURAN.

Materials.		Sr.	T.	M.
Soya bean pulse	...	1	0	0
Water	...	3	0	0

Put a pan containing water on fire. When water reaches the boiling point, wash soya pulse; and let it cook covering the lid. When half cooked, take the water in a pan and crush the pulse between two stones. Then put the heated water again to boil and when the pulse cooks completely take out water which can be used to make Sar and other dishes.

Materials.		Sr.	T.	M.
Molasses	...	1	10	0
Cardemum	...	0	1	0

Add the above materials to the cooked pulse, when it gets well mixed stir them together to allow it to cook.

Method.

2. Then take the dough mass of the flours and take lump of the size of a lemon and roll it in rice flour kept in a tray. Then put the lump on a circular wooden slab and roll the mass in circular flat shape. Put three times the mass of puran made above and close the roti on all sides by pressing at the sides and roll it over again slowly into a circular shape. Then put flat pan of thick size on slow fire and when the poli cooks on one side turn it over to the other side and let it cook. When preparing fried puran polis take 1 seer of ghee and pour it round with a spoon when polis are being cooked on a flat pan. Fold up and serve them cool. If polis are not fried they are eaten either with ghee, milk or coconut juice sweetened as desired.

Sanjyachi Poli.

Sanjyachi poli is prepared in the same way but instead of puran, sanja is prepared as follows. The other process is the same.

Materials.	Sr.	T.	M.
Whole wheat flour (thicker grain).	1	0	0

Materials.		Sr.	T.	M.
Ghee	...	0	20	0
Sugar	...	1	20	0
Cardamum	...	0	1	0
Water	...	0	20	0

Method.

Heat the water to a boiling point and add flour shortened with ghee and stir it well. Allow it to cook; then add sugar, cardamum and mix it up. Use this as puran.

Varieties of sweet polis are made as Suralichi poli, Gulachi poli, Ratalchi Poli, Panirchi poli, Bhure koholachi poli, Kandarp poli, Khapar poli, Khajur poli and other kinds.

Gharge.

Materials.		Sr.	T.	M.
Whole wheat thick flour	...	0	20	0
Soya flour	...	0	5	0
Salt	...	0	0	3
Ghee (shortening)	...	0	2	0
Water	...	0	20	0
Molasses	...	0	15	0
Ghee	...	0	37	6
Khaskhas	...	0	10	0

Method.

Take a pan containing water and put it over fire allowing it to boil. Put in molasses, ghee

and salt. Then put in the flours mixed together. Allow it to cook, stirring vigorously. Take lemon sized lump and thump it in flat circular shape. Put this in khaskhas on one side and fry in ghee. Serve them when cool.

Besan Laddu.

Materials.		Sr.	T.	M.
Thick gram flour	...	1	0	0
Soya flour	...	0	8	0
Ghee } for shortening	...	0	10	0
Milk } for shortening	...	0	5	0
Ghee	...	0	30	0
Milk	...	0	5	0

Method.

1. Mix the flours. Mix milk and ghee together and add the flour. Don't allow the flour to form any mass.

2. Take a pan and put it on fire. Heat the pan. Fry the flour on slow fire. When smell issues from the fried flour sprinkle milk slowly and stir well. Take the fried flour off the fire. Add the following :—

Materials.		Sr.	T.	M.
Sugar	...	1	0	0
Grapes dried	...	0	5	0
Cardamom	...	0	0	6

Stir the flour so as to mix it well. Make the laddus of the size of sweet lemons.

Bundi laddus.

Materials.		Sr.	T.	M.
Gram flour (thick)	...	1	0	0
Soya flour	...	0	8	0
Ghee	...	0	5	0
Salt	...	0	1	0
Water	...	2	20	0

Method.

Mix the flours together. Put in ghee as shortening. Add salt and mix it well. Add cold water and make as semi-liquid form allowing to form no thick mass in the flour.

PREPARING KALIS.

Put the pan containing ghee 1 sr. 5 tolas on fire. Heat the ghee. Take a perforated flat pan called zara and drop the semi-liquid form stroking the zara gently when pea shaped kalis will drop into the heated pan.

PREPARATION OF SUGAR PAK (CHASANI).

Materials.		Sr.	T.	M.
Sugar	...	2	0	0
Water	...	1	0	0

Put a pan on fire and put in sugar and water and heat it. Add milk to wash away dirt. Lessen the fire when sugar boils. Remove dirt by flat spoon (zara); apply more

heat when no dirt comes up. When 3 threads issue from the drop of a sugar take off the pan. Drop in the kalis. When they are soaked in chasani for an hour or so, form laddus of the size of sweet lemon. Serve them when cool. ...

SOME ADD THE FOLLOWING SPICES.

Materials.		Sr.	T.	M.
Almonds	...	0	5	0
Grapes	...	0	5	0
Cardamum (powder)	...	0	0	6
Mace (powder)	...	0	0	3

Motichur laddus, dal laddus, chhuta laddus, Mungdal laddus, Bhakar laddus, til laddus, khaskhas laddus and gul papdi can be prepared as besan laddus. Chhota laddus are prepared by frying small handfuls of dough in ghee and then adding ghee and sugar or molasses. For preparing Bhakar laddus bake bhakars on flat pans over fire and then morter and add ghee, sugar or molasses. Coconut crushed and khaskhas are sometimes mixed in the laddus to give more relish.

Soya bean Chevda.

Materials.		Sr.	T.	M.
Fried rice (Murmura)	...	1	0	0
Green chillies	...	0	0	5

Materials.		Sr.	T.	M.
Ginger green	...	0	1	0
Oil	...	0	20	0
Turmeric	...	0	1	3
Asafoetida	...	0	0	1
Soya pulse (soaked at night and drained)	...	0	10	0
Cocount	...	0	2	0
Coriander (green	...	0	2	0
Salt	...	0	1	0
Chillies (powder)	...	0	0	5
Rye	...	0	0	3
Cashu nuts	...	0	5	0
Ground nuts	...	0	5	0
Potatoes and onions (both sliced)	...	0	5	0

Method.

Take a pan containing ghee or oil and put it on fire. Fry the rice, pulse, sliced patato and onions and nuts separately. Crush all the spices to powder and mix them well.

Chevada as an entertainment is relished by all.

Methkut.

Materials.		Sr.	T.	M.
Wheat	...	0	20	0
Rice	...	0	20	0
Gram pulse	...	0	20	0
Udid pulse	...	0	20	0

Materials.		Sr.	T.	M.
Mung ,,	...	0	20	0
Chola ,,	...	0	20	0
Muth ,,	...	0	20	0
Pea ,,	...	0	30	0
Soya ,	...	0	30	0
Coriander	...	0	5	0
Variali	...	0	5	0
Cloves	...	0	1	0
Cinamum	...	0	5	0
Chillies (powder)	...	0	5	0
Pepper	...	0	1	0
Asafoetida	...	0	0	3

Method.

Bake the above materials till brown stirring with a flat spoon. Grind them and pass through sieve and fill in bottles. Mix in sweet curd. Add salt to taste.

Anarsa.

Materials.		Sr.	T.	M.
Plantains	...	0	15	0
Rice	...	1	0	0
Soya pulse	...	0	10	0
Ghee (shortening)	...	0	8	0
Sugar	...	1	0	0
Milk	...	0	1	0
Khaskhas	...	0	5	0
Ghee	...	1	0	0

Method.

Mix the flour with sugar. Add milk. In the morning take a circular flat wooden slab and spread khaskas over it. Take small lump and form it into a circular flat cake. Fry in ghee on the side without khaskhas. Serve when cool.

Gul papadi.

Materials.		Sr.	T.	M.
Molasses	...	2	0	0
Wheat flour	...	1	0	0
Soya flour	...	0	15	0
Cardamum	...	0	1	0
Mace	...	0	0	2
Ghee	...	1	0	0

Method.

Put a pan over fire and fry the flours mixed together in ghee. Put molasses and ghee in another pan and when mixed together and boils hot add the fried flours little by little stirring well till all the flour is over. Spread out a tray and when cool cut into oblong cakes and servet hem cool. Cardamum and mace may be added before spreading out the lump in the trays.

Kaval Vadi.

Materials.		Sr.	T.	M.
Soya flour (fried)	...	0	30	0
Wheat flour (fried)	...	0	10	0
Ghee or oil	...	0	30	0
Coconut (fried)	...	0	25	0
Khaskhas ,,	...	0	10	0
Soya pulse ,,	...	0	2	6
Sesamum	...	0	10	0
Cardamum	...	0	0	6
Mace	...	0	0	3
Coriander	...	0	5	0
Mace leaves	...	0	0	4
Cloves	...	0	0	3
Cinamum	...	0	0	6
Ginger	...	0	0	3
Sages	...	0	1	3
Pepper	...	0	0	6
Variali	...	0	0	3
Dagadful	...	0	0	2
Tamalpatra	...	0	0	2
Asafoetida	...	0	0	3
Turmeric	...	0	0	3
Salt	...	0	4	0
Chillies	...	0	6	0
Onion	...	1	0	0
Garlic	...	0	5	0
Ginger green	...	0	5	0
Lemon	...	0	10	0
Coriander green	...	0	10	0
Chillies green	...	0	10	0

Method.

The vadis can be made in a kerchief as well as without it by crushing the above materials between two stones and taking small lumps on a wooden slab, and leaving them to dry. Coriander green vadis can be made by adding 2 seers of coriander green to the above mixture.

Pungent cakes, Puris.

Materials.		Sr.	T.	M.
Soya flour	...	0	10	0
Rice flour	...	1	0	0
Ghee or oil	...	1	0	0
Coconut	...	0	10	0
Coriander	...	0	2	6
Sages	...	0	1	0
Asafoetida	...	0	0	3
Turmeric	...	0	1	0
Salt	...	0	3	0
Chillies	...	0	3	0
Onions	...	0	20	0
Garlic	...	0	5	0
Coriander green	...	0	10	0
Chillies green	...	0	10	0

Method.

Mix the flour, and adding shortening add all the spices. Make into a thick dough and beat it soft. Roll it over wooden flat circular

slab and cut the roll into round puris with the help of a small cup. Fry in ghee and serve them when cool.

Thali pit.

Materials.		Sr.	T.	M.
Soya pulse	...	0	15	0
Bajri (millet)	...	0	15	0
Wheat	...	0	10	0
Udid pulse	...	0	5	0
Ghee or oil	...	0	20	0
Coriander	...	0	2	6
Sages	...	0	1	0
Asafoetida	...	0	0	3
Turmeric	...	0	1	0
Chillies	...	0	5	0
Salt	...	0	3	0
Onions	...	0	20	0
Garlic	...	0	5	0
Coriander green	...	0	10	0

Method.

Bake the materials and crush them to powder in grinding stones. Cook over slow fire in a pan with boiling hot water. Put fire on the top of the pan covering lid on and putting fire over the lid. When the lump is cooked allow it to cool and serve the oblong cakes by cutting from them from the pan. Thalipit is eaten with oil or ghee.

Khema soya bean amti.

Materials.		Sr.	T.	M.
Khema	...	0	20	0
Soya pulse	...	0	20	0
Ghee	...	0	10	0
Coconut	...	0	20	0
Sages	...	0	0	4
Asafoetida	...	0	0	3
Salt	...	0	3	0
Chillies dry	...	0	3	0
Onion	...	0	30	0
Garlic	...	0	5	0
Ginger	...	0	5	0
Lemon	...	0	5	0
Coriander green	...	0	5	0
Chillies green	...	0	7	6
Turmeric	...	0	1	0

Method.

Fry onion, garlic, ginger in ghee when they are sliced. Let them be white brown. Crush the pulses soaked in water and spices together between two stones and cook them soft in boiling water. Do not allow to get the lump over cooked but stir it well over the fire. Add green spices and allow it to boil. Fumigate and serve when off the fire. Amti is eaten with bread or rice.

(5) Bengali Soya Bean Dishes.

Mihinana Sweet.

Materials		Sr.	T.	M.
Gram flour	...	0	30	0
Rice flour	...	0	8	0
Soya flour	...	0	20	0
Almond seeds	...	0	5	0
Pistachio nuts	...	0	5	0
Grapes	...	0	5	0
Mava	...	0	20	0
Cardamom	...	0	1	0
Sugar	...	2	0	0
Ghee	...	3	0	0

Method.

Mix the flours and add a little ghee for shortening. Take a pan and mix the flours in water allowing no thick masses to form. Let the pan stand for an hour. Put another pan on fire and put Ghee in it. When it is hot prepare bundi with a perforated spoon and allow the bundi to fry light brown. Prepare chasani and mix the bundi with it. Add spices and prepare lemon size Laddus; Serve them when cool.

Darfes Sweet:

Materials		Sr.	T.	M.
Gram flour	...	0	30	0
Soya flour	...	0	10	0

Materials.		Sr.	T.	M.
Almond seeds	...	0	5	0
Pistachio seeds	...	0	5	0
Grapes	...	0	5	0
Mava	...	0	20	0
Sugar	...	1	25	0
Kesher	...	0	0	3
Milk	...	0	5	0
Ghee	...	1	20	0

Method.

Mix the flours and add a little shortening. Take a pan and mix the flours with water allowing no thick mass to form in it. Let it stand for an hour. Take another pan and put ghee in it. When hot fry Motichur with a perforated spoon. Mix the Motichur with Mava and sugar adding as much milk as required to form laddus. Add spices when cool and serve.

Chhuta Gaja, Gajia, Chaukhuni Gajia Sweets.

Materials	Sr.	T.	M.	Sr.	T.	M.	Sr.	T.	M.
Wheat flour.	0	20	0	0	10	0	1	0	0
Soya flour ...	0	4	0	0	2	0	0	8	0
Sesamum ...	0	1	0				0	5	0
Sages ...	0	0	2				0	1	0
Sugar ...	1	0	0	0	2	6	1	20	0

Materials.		Sr.	T.	M.	Sr.	T.	M.	Sr.	T.	M.
Ghee	...	1	0	0	0	10	0	1	20	0
Cardamom	...							0	1	0
Cinnamon	...							0	0	3
Cloves	...							0	0	3
Pepper	...							0	0	3
Water	...		q.	s.		q.	s.		q.	s.

Method.

Mix the flours, add spices, shortening and knead into doughs. Take small lumps and

No. 1. Roll into flat circular shape and cut into oblong cakes. Fry them and soak in Chasani; serve when cool.

No. 2. Divide the lumps upto half the portion with the top of the knife held upside down. Fry and serve when cool.

No. 3. Roll into flat circular shape; Cut into oblong shapes. Fry and soak into Chasani. Serve when cool.

Meva Shinghade.

Preparation same as Ghugra of Gujarati style. Lumps to be rolled oblong and made into singhade shapes to be fried over slow fire taking sufficient care not to fry brown and served when cool.

Perakahi Sweet.

Materials		Sr.	T.	M.
Wheat flour	...	1	0	0
Soya flour	...	0	10	0
Sugar	...	1	0	0
Mava	...	0	10	0
Cardamom	...	0	1	0
Pepper	...	0	1	0
Sages	...	0	0	5
Ghee	...	1	20	0
Cocoanut	...	2	0	0
		Two in number.		

Method.

Mix the flours, add 5 tolas of shortening. Mix well. Make a dough using requisite water. Fry mava and spices. Use it as puran and fill Ghugaras. Fry and soak in chasani. Serve when cool.

Balushahi.

Materials.		Sr.	T.	M.
Wheat flour	...	0	30	0
Soya flour	...	0	10	0
Ghee	...	1	0	0
Sugar	...	0	20	0
Cardamom	...	0	1	0
Pepper	...	0	0	6

Method.

Mix the flours, add shortening 10 tolas. Mix well, add spices. Knead into a dough with sufficient water. Make small lemon size lumps and perforate them at the top. Fry in Ghee and soak in chasani. Serve when cool.

Khaja.

Materials		Sr.	T.	M.
Wheat flour	...	1	10	0
Soya flour	...	0	12	0
Rice flour	...	0	10	0
Sugar	...	2	0	0
Ghee	...	2	0	0

Method.

Mix the flour with water adding shortening and knead it into a dough. Keep it for three hours. Roll into a flat shape. Add rice flour mixed with ghee, spreading it over the flat shape. Roll into a cylindrical shape. Take small lemon size lumps of the material and roll again to a flat circular shape. Perforate with fingers on one side. Fry in Ghee and soak into chasani. Serve when cool.

Rasagulla.

Materials		Sr.	T.	M.
Chhana coagulated milk drained off to a thick mass. (Use tamarind water)		1	30	0
Soya flour	...	0	10	0
Sugar	...	2	0	0
Sandal oil	...	0	0	2

Method.

Mix Chhanna and soya flour together. Knead into a dough, take a tola weight of this lump and apply sandal oil to it. Fry in Ghee and soak into one thread chasani. Boil it twice. Serve when cool.

Sulaka Dal.

Materials		Sr.	T.	M.
Soya pulse	...	0	10	0
Tamal Patra	...	0	0	3
Sages	...	0	0	2
Variali	...	0	0	2
Sugar	...	0	0	6
Milk	...	0	20	0
Ghee	...	0	3	0

Method.

Place pan over the fire and pour water in it. When boiling hot put in soya pulse, allow to cook. Then take it out and crush

the cooked pulse, and cook it again. Fumigate it by putting another pan over fire and putting ghee in it and adding spices. Add milk and boil twice over stirring it. Serve when slightly cool.

Fulari.

This is the same as Vadas in Maharastra dishes.

(6) GOA DISHES AND CEYLON DISHES.

Dodol.

Materials		Sr.	T.	M.
Coconuts	...	2	0	0
Molasses	...	2	20	0
Wheat flour	...	0	15	0
Soya flour	...	0	5	0
Salt	...	0	0	3

Method.

Crush the cocoanuts and take out all the water by squeezing, repeat adding water and squeezing till 4 seers of water is collected. Dissolve molasses in the water so collected. Mix water in flour allowing no thick mass to form therein. Place a pan over the fire and boil the liquid stirring it till it gets thick. Spread it in a tray 2 ins. thick. Cut into oblong

cakes like Barfi. Mix cashu nuts, ground nuts and spread over hot dodol before this. Cardamom and Vanilla are also spread as a relish of the dodol Serve when cool.

Cude.

Materials.		Sr.	T.	M.
Rangoon Halwa rice	...	0	20	0
Sugar	...	0	30	0
Ghee	...	0	20	0
Soya flour	...	0	15	0
Almond	...	0	5	0
Cocoanut	...	0	10	0
Rose water	...	0	20	0
Cardamom	...	0	1	0
Mace	...	0	0	6
Wheat flour thin	...	0	10	0
Wheat flour thick	...	0	10	0

Method.

Mix the flours, add shortening,: take green cocoanuts, add the water to the flour over slow fire, let a hard mass be formed. Remove it to a tray and spread almond slices, cardamom, mace etc. Crush the cocoanut and cook it in water over fire before mixing in the flour. Mix sugar in flour before dropping hot boiling cocoanut milk and water mixed. Cut the lump into oblong pieces and serve when cool.

Latrei

This is the Portugese marriage dish. It is prepared in the following manner.

Materials		Sr.	T.	M.
Sugar	...	3	0	0
Soya loaf bread (avoid brown part)		1	0	0
Coconut	...	0	30	0
Almond seeds	...	0	5	0
Cashu nut seeds	...	0	5	0
Pistachio	...	0	5	0
Grapes red	...	0	5	0
Grapes black	...	0	5	0
Butter	...	0	10	0
Egg pulp	...	0	12	0
Rose water	...	0	5	0
Cardamom	...	0	0	2
Mace	...	0	0	2

Method.

Crush the spices to powder or slices. Soak the bread into water and reduce it to powder. After draining out all the water, pour out egg pulp in chasani so as to make it assume the form of shevaya. Put in the powdered bread and spices in chasani and stir till it forms a thick mass. Heat it in an oven, arrange the shevaya of egg pulp crosswise so that it forms perfect squares like lattice. Add essence Vanilla.

Vatkadoshi–a Ceylon dish.

This is a great relish in Colombo. It is prepared from the following materials.

Materials		Sr.	T.	M.
Sugar	...	1	20	0
Cashu nut baked	...	1	0	0
Butter	...	0	20	0
Wheat flour	...	0	20	0
Soya flour	...	0	5	0
Eggs	...	0	16	0
Cardamom	...	0	1	0
Mace	...	0	1	0
Butter	...	0	5	0

Method.

Mix the flours, add 5 totals shortening. Bake the flour in an earthern pot till it assumes almond colour and smells sweet. Crush cashu nuts to powder. Mix egg pulp with butter. Mix flour into it. Bake the mixture in an oven till brown, add mace and cardamom. Cut into diamond shapes. Serve when cool after adding Essence Vanilla for flavour.

(7) TANJORE DISHES.

Dahi Burani.

Materials		Sr.	T.	M.
Curd	...	1	0	0
Sugar	...	0	10	0

Materials.		Sr.	T.	M.
Grapes	...	0	2	0
Citron One	...	0	5	0
Mosambi ,,	...	0	5	0
Shep ,, (apple)	...	0	3	0
Plantains two	...	0	10	0

Select the best kind of fruits, wash them in water and cut them in slices. Soak them in curd for three to four hours and then serve.

Anannas Pulav, Sugarcane Pulav.

Materials		Sr.	T.	M.
Delhi Rice	...	1	0	0
Anannas (one)	...	2	0	0
or Cocoanut (green)	...	1	0	0
(Any of these may be substituted for variety in taste. Eggs, mutton or meat may be dropped for Brahmin dishes.)				
Sugarcane (juice)	...	5	0	0
Cashu nuts	...	0	20	0
Plantains eight	...	3	0	0
Eggs six or meat	...	1	0	0
Mutton	...	1	0	0

Biriani, Mutanjan, Mujaffar.

Materials.		Sr.	T.	M.
Grapes	...	0	5	0
Sugar	...	1	20	0
Ghee	...	1	0	0

Materials.		Sr.	T.	M.
Almonds	...	0	5	0
Pistachio	...	0	5	0
Saffron (cochineal or green colour may be used.)	...	0	0	3
Otto hina musk	...	0	0	1
Rose water or Keoda water.		0	10	0
Cardamom	...	0	1	0
Mace	...	0	0	3
Lemon	...	0	1	0
Milk	...	1	0	0
Cream	...	0	5	0
Mava	...	0	10	0
Soya flour	...	0	20	0
Onion	...	0	15	0
Garlic	...	0	2	6
Cloves	...	0	0	6
Cinnamon	...	0	0	6
Salt (for biriani.)	...	0	0	6
Alum (for biriani.)	...	0	1	0

Method.

Clean the meat pieces in water. Apply salt, onion ginger green and coriander gr., fumigate the meat with onion and mix with curd. When meat cooks, add spices crushed to powder Tay. Cook rice 1 sr. 4 sr. water add 2 t. salt. Spread rice over Tay. Fumigate ghee with cloves, mace, cardamom and

spread over rice; add saffron ground down in water to 5 t. rice and put it on one side in the rice. Take rice flour and mix with water into a paste. Touch the border of the pan with this paste and put lid on. When steam issues from under the lid the Biriani is ready.

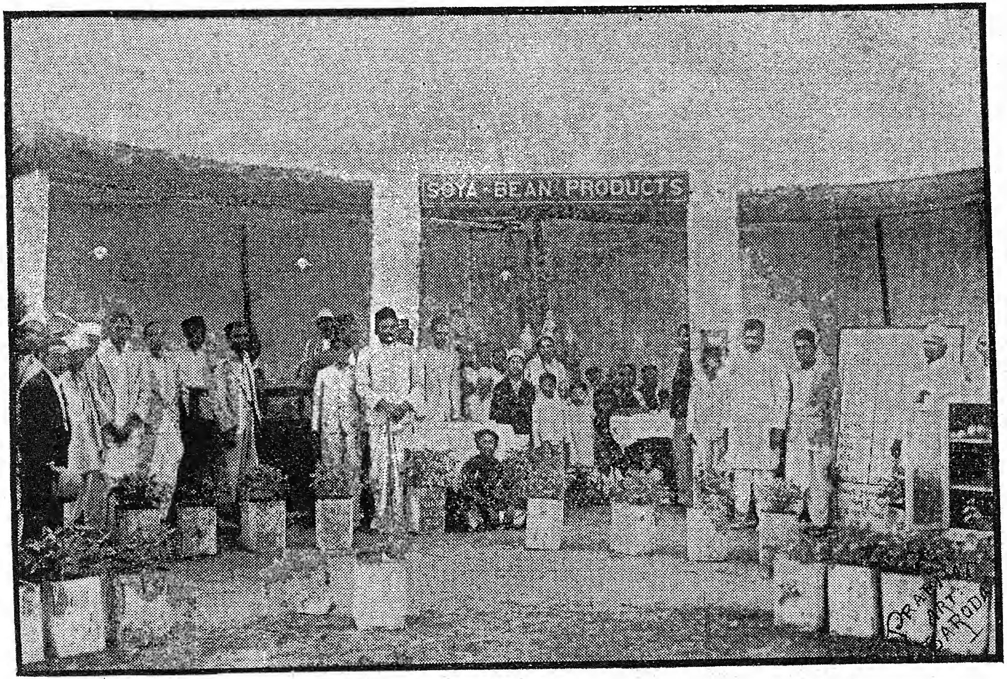
2. Wash meat in cold water; cook it in boiling hot water. Add onion, coriander, ginger, both green and garlic and allow it to cook. When meat is half cooked pass the water in the cooked meat in another pan. Add more ginger and garlic to the cooked meat. Fumigate the meet with ghee, onion, cloves and cardamom. Prepare Chasani one thread and add it on to meat. Fumigate the water and cook rice in it. Divide rice in three parts and put salt over one. Put meat over one part spread over with salt and cover with rice. Add cream and put second part of the meat; cover over with rice again and add saffron, rose water and curd. Put almond slices etc.; allow to steam over slow fire and when ready put ghee in it. Remove off the fire and serve when cool. This is Muttanjan.

Bakre Yesur.

Materials.		Sr.	T.	M.
Mutton	...	1	0	0
Ghee	...	0	15	0
Cocoanut	...	0	7	6
Khaskhas	...	0	1	0
Soya Pulse	...	0	1	0
Sesamum	...	0	1	0
Wheat	...	0	1	0
Bajri Millet	...	0	1	0
Rice	...	0	1	0
Cardamom	...	0	0	3
Coriander	...	0	0	3
Cloves	...	0	0	2
Cinamon	...	0	0	3
Pepper	...	0	0	3
Sages	...	0	0	3
Dagadful	...	0	0	3
Tamalpatra	...	0	0	3
Badiyan	...	0	0	3
Variali	...	0	0	3
Asafoetida	...	0	0	9
Turmeric	...	0	0	3
Salt	...	0	2	6
Chillies	...	0	3	0
Onions	...	1	0	0
Garlic	...	0	2	6
Ginger	...	0	2	6
Lemon	...	0	5	0
Coriander Gr.	...	0	5	0

Method.

Fry or bake the corn brown and grind them. This is called Yesur. Fry the spices in ghee or oil and crush them to powder. Wash meat clean twice or thrice. Apply garlic, ginger and turmeric. Fry onion in ghee till brown white and fumigate meat with the same. When meat is well cooked add coriander gr., lemon and mix yesur with boiling hot water, allow it to cook. Add it to meat and when boiled twice over remove the pan off the fire. Serve when cool.



Soya Bean Restaurant at the Rural Life Exhibition Baroda on the occasion of H. H.'s Diamond Jubilee, 7-1-36.

A RÉSUMÉ.

We are now at the end of our task. It is rather difficult to present a proper résumé of such a vast subject, however, a brief survey of the vital points emphasised in this book may not be inappropriate at this stage.

In the opening pages attention was invited to the deficiencies of the Indian dietary. No body can fail to notice the grievous consequences of the faulty dietaries in India. We perceive a gradual decline in the stature, body weight, efficiency and longevity of the race due to improper diet. The dietetic survey of India reveals that wheat forms the staple article of diet in Punjab, Sind, United Provinces, Rajputana, Central India and Behar; while rice forms the staple article of diet in Burma, Assam, Bengal, Orissa, Madras, Ceylon and part of the Bombay Presidency. A staple article of diet should be as perfect as possible from the nutritional, biological, and physiological point of view. There can be no argument against the truth

of this proposition. Wheat is found deficient in fat, mineral salts and vitamins A,C and D. Rice on the other hand is deficient in mineral salts and vitamin B and partly in vitamins A, C and D. The protein of rice is poor in quantity and quality as well. To make up the above deficiencies the inclusion of milk, fresh fruits, vegetables, meat, fish and eggs are recommended. But considering the economic aspects and the income *per capita,* this is far beyond the means of an average Indian. Various experiments carried out by the author on rats, babies and adults go to support the claim of soya bean as the most nutritious article of food.

Tea and coffee are the prevailing dangers to the health of the people, as they contain tannin and caffeine respectively. Those who cannot give up these things may safely introduce soya bean coffee instead. It is not only a beverage, but a nutritious food. Diabetes has now become a common complaint. Soya bean is a boon to the diabetic patients, as it is almost free from starch and sugar. The patients suffering from nervous diseases, rickets

and tuberculosis find in soya bean a blessing as it contains lecithin. Soya bean in the form of "soyolk" is a very nutritive food for the invalids.

Apart from its nutritive superiority, soya bean is useful for its other qualities as well. The investigations of Prof. Dhar of Allahabad University have shown that the Indian soil is deficient in Nitrogen. Soya bean possesses the marvellous property of enriching the soil by absorbing the nitrogen from the air. The Crop Conference to the Government of India held at Delhi last year recommended soya bean as a rotation crop. Soya bean is the only crop which can give the pods within a short period of 6 to 7 weeks. It can be grown all the year round even in summer with adequate water supply.

There is scarcity of milk in India due to absence of good fodder. Experiments have proved soya bean fodder to be very rich in nutritious elements and very beneficial to live stock. Soya bean milk is recommended and can be used in India where people cannot afford to buy cow's milk.

A RÉSUMÉ

Cultivation of soya bean on a large scale will considerably enhance the trade of India. We have seen in the chapter on "Soya bean oil industry" that soya bean contains from 18 to 24 per cent of oil. The oil of soya bean contains vitamin A. Whenever there is a shortage of olive oil in the world's market soya bean oil is substituted for it. It being an oil, of a semi-drying nature enters into the manufacture of paints, varnishes, linoliums, paper umbrellas and many other articles. It can by the process of hydrogenation be turned into margarine, lard, vegetable ghee etc. Soya bean oil plays a great part in the manufacture of soaps, glycerine, oil cloth, imitation rubber and many allied products. Japan is one of the leading countries producing celluloid toys as celluloid compounds are prepared from soya bean cassein.

Every year England and other European countries purchase large quantities of soya bean oil and cake mainly from China and Japan. If proper impetus is given to the development of soya bean cultivation in India,

in a few years to come she will be in a position to supply the demand. The production of soya bean will open new markets of commerce for India. If we take stock of the various points discussed so far, we shall be convinced that soya bean not only will serve as a balancing diet but will also help to develop the trade and industries of the country.

It may not be out of place to take this opportunity of requesting the agricultural authorities of the various provinces in India and Indian States to take keen interest in the cultivation of soya bean and to investigate into the conditions suitable to the growth of the particular varieties suited to their respective soils and the farmers should be advised to grow those varieties only.

Lastly I have to request the leaders of Indian thought to take up the problem of national nutrition in their programme of "village uplift" and educate the general masses in the nutritive values of this most important bean and encourage its cultivation and use on an extensive scale.

A Résumé

We are at a crisis of our national dietary system. The time has come when we must make ardent and united endeavours for making up the deficiency in the present diet or the Indian Nation will sink again perhaps for centuries to come. If we are to make our position among the strong and civilized nations of the world we must supplement our deficient dietary system by a food stuff rich in proteins, fats and vitamins and low in starch and carbohydrates. To raise the standard of our staple food is a national service and one way of reaching this goal is by incorporating soya bean in our daily diet. If we do not do this now we shall be betraying a sacred trust and be false to our own posterity.

APPENDICES.

APPENDIX

Acreage of soya bean in Manchuria

	1931	1932
South Manchuria.	1,726,640	1,769,601
North Manchuria.	2,473,950	1,927,975
Total ...	4,200,590	3,697,576

Total crop production.

	1931	1932
South Manchuria.	2,173,560	2,187,480
North Manchuria.	3,053,450	2,080,410
Total ...	5,227,010	4,267,890

Soya Bean.

I.

during last 5 years.

1933	1934	1935
1,810,860	1,729,410	1,641,496
2,189,810	1,574,420	1,690,744
4,000,670	3,303,830	3,332,240

(Unit kilo tons.)

1933	1934	1935 (expected).
2,549,470	3,346,814	3,822,287
2,051,530	...	...
4,601,000	3,346,814	3,822,287

APPENDIX

Total figures of Export

	Japan.	Europe.
	Tons.	Tons.
Oct. 1930 to Sept. 1931...	491,212	1,453,675
Oct. 1931 to Sept. 1932...	503,689	1,389,401
Oct. 1932 to Sept. 1933...	399,277	1,650,495
Oct. 1933 to Sept. 1934...	497,933	1,786,527
Oct. 1934 to Sept. 1935...	507,673	1,111,958

SOYA BEAN.

II.

during last 5 years.

China.	Java and Malaya.	Others.	Total.
Tons.	Tons.	Unit Kilo tons.	Tons.
405,418	88,052	141	2,438,498
502,446	72,121	30	2,467,687
103,916	53,764	3	2,207,455
71,187	41,321	...	2,396,968
141,468	20,402	17,557	1,799,058

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